BG Pulse Journal USA
ISSN:1947-2536 http://www.bgpulseusa.com/index.php/bg
BG PULSE JOURNAL

ARTIFICIAL INTELLIGENCE IN MODERN DENTISTRY: CURRENT APPLICATIONS, ADVANTAGES, AND FUTURE PERSPECTIVES

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Abstract: This article examines the modern applications of artificial intelligence in dentistry. The main areas of digital technology use in diagnostics, orthodontics, implantology, and therapeutic dentistry are analyzed. Special attention is given to the advantages of implementing intelligent systems, their impact on treatment quality, and future development prospects. In the context of the rapid digitalization of healthcare, artificial intelligence is becoming an important tool for supporting clinical decision-making and improving the efficiency of dental practice.

Keywords: Artificial intelligence, dentistry, digital dentistry, diagnostics, machine learning, orthodontics, implantology, radiography.

Introduction

Modern dentistry is one of the most rapidly developing fields of medicine. In recent years, digital technologies have gained particular importance, enabling improved diagnostic accuracy and higher quality of treatment. One of the most promising areas is the use of artificial intelligence. Artificial intelligence refers to a set of technologies capable of analyzing large volumes of data, identifying patterns, and assisting healthcare professionals in clinical decision-making.

The growing amount of medical information requires new approaches to data processing. Therefore, artificial intelligence systems are increasingly being integrated into dental practice. They enable the analysis of radiographic images, prediction of treatment outcomes, and automation of routine clinical processes.

Application of artificial intelligence in diagnostics

Diagnostics is the foundation of successful treatment of dental diseases. Modern artificial intelligence algorithms are capable of analyzing panoramic radiographs, intraoral X-rays, and computed tomography (CT) data. Based on the obtained information, these systems detect signs of dental caries, periodontal diseases, cysts, granulomas, and other pathological conditions.

The use of artificial intelligence helps improve diagnostic accuracy and reduce the risk of missing pathological changes. Through training on large datasets of clinical cases, these systems continuously improve their performance and become effective tools supporting dental practitioners. The application of such technologies is particularly important in situations of high workload on healthcare professionals.

Artificial intelligence in orthodontics

In orthodontics, digital technologies are used for analyzing tooth position and planning treatment. Modern software systems are capable of automatically identifying anatomical landmarks on radiographic images and constructing three-dimensional models of the dentoalveolar system.

With the help of artificial intelligence, it is possible to predict tooth movement during the course of treatment, evaluate the effectiveness of different therapeutic approaches, and create virtual models of the expected outcome. This improves communication between the clinician and the patient and increases the predictability of orthodontic treatment.

Artificial intelligence in implantology and oral surgery

Implantology is one of the most technologically advanced fields of dentistry. Artificial intelligence assists in the analysis of computed tomography data, assessment of bone volume, and selection of the optimal implant position.

Based on digital planning, surgical guides are created, which significantly improve the accuracy of implant placement. The use of such technologies helps reduce the risk of complications and enhances long-term treatment outcomes. In oral surgery, artificial intelligence is also applied to evaluate patient-specific anatomical features and to prepare for complex surgical procedures.

Advantages of artificial intelligence applications

The main advantage of artificial intelligence is its ability to process large volumes of information in a short period of time. This enables faster diagnostics and improves the quality of medical care.

Other advantages include a reduced likelihood of diagnostic errors, increased accuracy in treatment planning, improved management of medical documentation, and optimization of dental clinic workflows. In addition, artificial intelligence contributes to the development of personalized medicine by taking into account the individual characteristics of each patient.

Limitations and challenges of implementation

Despite its numerous advantages, the implementation of artificial intelligence is accompanied by several challenges. One of the main issues is the high cost of software and hardware. In addition, healthcare professionals require training to effectively work with these new technologies.

Issues related to patient data protection and the security of medical information are also of critical importance. It should be noted that artificial intelligence cannot fully replace the dentist. The final clinical decision must always be made by a qualified specialist based on clinical findings and professional experience.

Future development prospects

In the future, further expansion of artificial intelligence applications in dentistry is expected. Advances in machine learning technologies will enable the development of more accurate diagnostic systems and improve predictive models for treatment outcomes.

Significant interest lies in the integration of artificial intelligence with telemedicine, robotic systems, and digital healthcare data management platforms. All these developments will contribute to improving access to dental care and enhancing the quality of patient treatment.

Conclusion

Artificial intelligence is becoming an essential component of modern dentistry. Its application contributes to improved diagnostic accuracy, enhanced treatment planning, and the advancement of digital technologies. Despite existing limitations, further development of algorithms and software solutions will significantly expand the capabilities of dental practice. In the coming years, artificial intelligence is expected to play an increasingly important role in the development of both dental science and clinical practice.

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