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Review Article

Artificial Intelligence In Dentistry: Hope Or Hype

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ABSTRACT
Artificial intelligence (AI) encompasses the simulation of human cognitive functions in machines that are engineered to demonstrate intellectual capabilities and to learn in a manner similar to humans. The concept of the soul was articulated by numerous religious thinkers, who regarded it as a lasting and inherent quality granted to humans by a divine entity.This current review discusses the use, limitations, and future potential of AI in dental diagnostics and treatment. It covers image analysis, predictive modeling, record management, and dental research advancements. AI is expected to improve care delivery by reducing repetitive tasks for dental professionals, leading to better health outcomes and lower costs. This could foster a more personalized and preventive approach to dentistry. However, widespread adoption of AI in dental practice is hindered by challenges related to data availability and accessibility.
Key words: Artificial intelligence, Dentistry

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INTRODUCTION

Artificial Intelligence (AI) encompasses the disciplines of science and engineering dedicated to the development of intelligent machines. These machines utilize algorithms or predefined rules to replicate human cognitive abilities, including learning and problem-solving. AI systems possess the capability to foresee challenges and address issues as they arise, thereby functioning in a deliberate, intelligent, and adaptive manner. The core strength of AI lies in its proficiency to learn from and identify patterns and relationships within extensive multidimensional and multimodal datasets. For instance, AI systems can condense a patient's comprehensive medical history into a singular numerical value that signifies a probable diagnosis. Furthermore, AI systems are characterized by their dynamic and autonomous nature, continuously learning and evolving as additional data becomes accessible.[1, 2]

AI IN ORAL MEDICINE AND RADIOLOGY

Artificial intelligence has been utilized to diagnose various oral conditions such as dental caries, maxillary sinus diseases, periodontal disorders, salivary gland issues, temporomandibular joint disorders, and oral cancers by analyzing clinical data and diagnostic images. Leveraging larger datasets could improve AI's capability to predict the development of precancerous conditions.[3]Additionally, AI can support population health monitoring and facilitate referrals to specialized practitioners. Its ability to detect microfeatures that might be invisible to the human eye enhances its predictive accuracy in critical diagnostic situations.[4]

AI IN PROSTHODONTICS

AI's role in prosthodontics is significant, evidenced by a recent and concentrated increase in literature on the subject, which accounts for 94% of publications over a condensed five-year timeframe. However, despite this recent proliferation of research, there exists a considerable gap in the understanding of the thorough

assessment and evaluation of AI applications within prosthodontics, particularly regarding their effectiveness in executing prosthodontic tasks. The applications of AI in this field encompass a variety of functions, including but not limited to delineating the finishing line on prepared teeth, assessing facial alterations in patients with removable prostheses, automating tooth morphology design, selecting color, simulating the casting process, and designing removable partial dentures.[5, 6]

AI IN ORAL SURGERY

AI algorithms have been employed to support surgeons in areas such as diagnosis, treatment planning, preoperative assessments, and predicting and evaluating outcomes. These algorithms enhance human expertise while addressing limitations through their abilities to learn, classify, predict, and identify patterns. Nonetheless, it is essential that these algorithms undergo thorough clinical evaluation, and a comprehensive ethical review should be undertaken concerning data privacy, inclusivity, and transparency.[7, 8] The integration of 3D simulation models and AI technology has the potential to transform functional and aesthetic surgical practices. Simulation systems can enhance planning, decision-making, and evaluations both during and after surgical procedures. Additionally, a surgical AI model can take on labor-intensive or complex tasks, alleviating some of the burdens on surgeons.[9]

AI IN PEDODONTICS

In the field of pediatric dentistry, artificial intelligence is tackling various longstanding issues, including the enhancement of diagnostic precision and the optimization of treatment strategies for younger patients.[10]A significant aspect of pediatric dentistry is the management of anxious or uncooperative children during dental appointments. To address this, AI-driven virtual reality (VR) and augmented reality (AR) technologies are being investigated to offer more engaging and less daunting dental experiences for children, thereby aiding in behavior management and alleviating dental anxiety. Furthermore, AI-enabled tools can deliver tailored oral health advice and preventive care plans based on specific risk factors, which is particularly advantageous in pediatric environments.[11, 12]

AI IN PERIODONTICS

Periodontitis ranks as the sixth most common disease globally. Artificial intelligence can assist in the early identification of periodontal disease by examining radiographs to detect alterations in bone density and periodontal tissues, facilitating timely intervention and improving treatment results.AI plays a crucial role in implant dentistry through digital 3D treatment planning, integrating intraoral 3D images with cone-beam computed tomography (CBCT)data in specialized software.[13]Recent software advancements enable precise 3D planning tailored to practitioners' preferences. By analyzing these scans, AI helps identify optimal implant sites, reducing surgical complications and improving implant success rates.[14, 15]

AI IN ORTHODONTICS

Artificial intelligence (AI) has proven effective in aiding orthodontists by extracting pertinent information from various data sets. This technology is utilized for analyzing clinical images, including automated landmark identification in lateral cephalograms, as well as assessing intraoral scans and photographic data. Additionally, AI supports orthodontists in making informed treatment decisions, such as determining the necessity for orthognathic surgery or orthodontic tooth extractions.[16]

AI IN ENDODONTICS

AI models, including convolutional neural networks (CNNs) and artificial neural networks (ANNs), are used in endodontics to analyze root canal anatomy, measure working length, identify periapical lesions and fractures, and predict retreatment success. CNNs excel in image-related tasks like segmentation and pattern recognition, while ANNs support decision-making and predictive modeling by adjusting connection weights based on input data. Combining these methods enhances the understanding and management of the root canal system.[17]

AI IN ORAL PATHOLOGY

AI algorithms possess the capability to evaluate patient data, medical records, and imaging results, enabling them to propose treatment plans and forecast outcomes. This technology has the potential to assist pathologists and clinicians in diagnosing and treating oral and maxillofacial pathologies, similar to its applications in various other fields. The objective of the present study was to explore the trends being researched in the domain of oral and maxillofacial pathology, particularly focusing on the role of AI in aiding practitioners.[18, 19]

CONCLUSION

In conclusion, while the integration of artificial intelligence in dentistry holds great promise for enhancing clinical practice and improving patient outcomes, it also brings forth a host of ethical dilemmas that require careful consideration. Addressing issues related to patient privacy, accountability.

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