GUEST EDITORIAL

Artificial intelligence in dentistry: a review of ChatGPT's role and potential

The significance of oral health spans various aspects of life, influencing overall health and wellbeing. Global dental health issues such as dental caries, periodontal diseases, and oral cancers persist despite advancements in diagnostic and treatment techniques. Innovations to enhance dental care and professional development are crucial, and artificial intelligence (AI) presents a promising solution. In this regard, ChatGPT, a sophisticated AI tool, shows potential for revolutionizing dentistry. Its role in improving diagnostic accuracy, treatment planning, patient communication, and professional development is increasingly recognized.[1]

AI has been used in dentistry for image analysis, pattern recognition, and decision support systems to help dental practitioners in diagnosis and treatment. As AI has evolved, machine learning and natural language processing (NLP) have gained traction in dental practice. The Generative Pre-trained Transformer (GPT) by OpenAI, and GPT-based tools like ChatGPT, have furthered the role of AI in dentistry. ChatGPT's remarkable understanding and generation of human-like text, given its training on extensive datasets, make it a potent tool for enhancing dental practice.[2] It can aid in patient communication, diagnostic suggestions, and treatment planning. It also promotes patient education, workflow efficiency, and supports continuing dental education (CDE). However, challenges to integrating AI tools like ChatGPT, such as data privacy concerns, ethical implications, and validation needs in clinical settings must be addressed. Successful AI implementation in dentistry requires collaboration among dental professionals, AI developers, and regulatory bodies. ChatGPT has shown considerable potential in dental research, offering support in literature review and data analysis by identifying relevant articles, summarizing key points, and analyzing extensive textual data for pattern and trend identification, thereby aiding in the production of accurate research outcomes.[2,3]

It also facilitates research collaboration and communication by improving knowledge exchange, offering advanced translation capabilities to overcome language barriers, and providing summarization features to quickly comprehend key points from lengthy publications. A Chrome extension powered by ChatGPT can efficiently summarize scholarly papers, offering valuable insights and saving researchers valuable time. However, its utility should be paired with the most current research literature due to its knowledge limitation up until September 2021. ChatGPT's application in dental education enhances personalized learning and simulation training. It can generate tailored study materials and provide adaptive feedback, contributing to individualized learning plans and improving comprehension and overall educational results. Furthermore, it can be integrated into simulation and virtual training environments, offering students a safe space for practice, and facilitating adaptive, personalized learning experiences. This integration enhances real-world preparedness by offering tailored feedback within immersive simulations.[4,5] Nonetheless, the balance between AI utilization and human expertise is crucial, with the guidance of human instructors remaining essential for effective learning experiences.

In dental practice, ChatGPT can significantly enhance patient education and communication. It provides real-time answers to patient queries and personalized explanations of dental conditions and treatment plans, resulting in improved patient engagement and satisfaction. This aligns with Kamalakannan and Eashwar's (2019) findings regarding AI's potential in patient communication and understanding enhancement.[5] Furthermore, ChatGPT can support evidence-based treatment planning and decision-making. As highlighted by Brattain et al,[6] AI models, through the analysis of complex patient data, can deliver evidence-based recommendations, thereby assisting informed decision-making. However, while beneficial, AI is intended to assist and not replace the expertise and judgment of dental professionals.[6]

Despite the promise of AI language models like ChatGPT in enhancing diagnostic accuracy, reducing costs, and improving patient outcomes in the field of dentistry, there are inherent ethical and practical challenges that necessitate cautious implementation. Among these challenges are issues of data privacy and potential biases that require dental professionals to remain vigilant in data protection, and compliance with ethical standards during AI-assisted analyses, while concurrently maintaining a transparent algorithmic framework to foster trust and enable

responsible AI application in dentistry. Additionally, AI developers are tasked with the responsibility of mitigating embedded biases within training datasets to ensure unbiased and impartial AI outputs. Equally, an overdependence on AI systems may compromise human expertise and critical thinking within the dental field, necessitating a balanced approach between AI utility and human insight. Various studies underscore the need for cautious AI integration and the humanization of AI-generated content, advocating for AI systems to serve as complementary tools rather than replacements for human expertise.[7]

Ensuring reliability of AI outputs, particularly for systems like ChatGPT, poses a significant challenge. Despite the system's proficiency in generating contextually relevant and coherent text, there can be instances of "hallucination," a phenomenon where the AI system, unable to find a correct answer, provides a plausible yet fabricated response, potentially leading to the dissemination of misinformation.[8] Further, the problem of misleading and fake data inclusion often arises, which can be characterized by the generation of inaccurate or unverifiable information related to dental treatment. For instance, the AI system might generate nonexistent or misleading citations, often associated with incorrect data. It is therefore paramount that all citations be diligently cross-verified to confirm their legitimacy and dependability as reliable sources.

To counteract fake data inclusion and improve AI content reliability, strategies such as rigorous validation, robust AI training, fostering human-AI collaboration, transparent algorithm formulation, and data source verification can be employed. Additionally, implementing reporting and response mechanisms will enable AI developers to identify areas of improvement, fine-tune their models, and enhance the quality of the produced content over time.

In conclusion, while AI presents a promising future in dentistry, including diagnostics, treatment planning, patient communication, education, and professional development, it is essential to strike a balance between leveraging AI capabilities and maintaining human expertise in the field. As the technology continues to evolve, collaboration between dental professionals, AI developers, and regulatory bodies is necessary to ensure the responsible and effective integration of AI into dentistry.
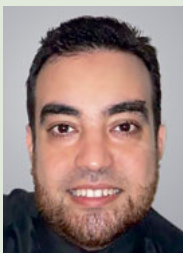
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References

1. Chen YW, Stanley K, Att W. Artificial intelligence in dentistry: current applications and future perspectives. Quintessence Int 2020;51:248–257.

2. Lample G, Conneau A. Cross-lingual language model pretraining. ArXiv 2019;arXiv:1901.07291.

3. Topol EJ. High-performance medicine: the convergence of human and artificial intelligence. Nat Med 2019;25:44–56.

4. Saghiri MA, Vakhnovetsky J, Nadershahi N. Scoping review of artificial intelligence and immersive digital tools in dental education. J Dent Educ 2022;86:736–750.

5. Kamalakannan S, Eashwar VMA. Artificial intelligence, dentistry and possible future implications. J Oral Biosci 2019;61:207–210.

6. Brattain M, Kim J, Lee J. Artificial intelligence in dentistry. J Korean Assoc Oral Maxillofac Surg 2018;44:75–79.

7. Nguyen TT, Larrivée N, Lee A, Bilaniuk O, Durand R. Use of artificial intelligence in dentistry: current clinical trends and research advances. J Can Dent Assoc 2021;87:l7.

8. Alkaissi H, McFarlane SI. Artificial hallucinations in ChatGPT: implications in scientific writing. Cureus 2023;15:e35179.

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