Is Artificial Intelligence an Underutilized Tool for Assisting Diagnosis in Dentistry?

¿Es la Inteligencia Artificial una Herramienta Subutilizada para Ayudar al Diagnóstico en Odontología?

**João Daniel Mendonça de Moura[1,2]; Ricardo Roberto de Souza Fonseca[1,2];
Silvio Augusto Fernandes de Menezes[1,2] & Patrícia de Almeida Rodrigues[1,2]**

Dear Editor

In a recent study by Mendonça de Moura *et al.* 2023, the authors evaluated the potential of artificial intelligence chatbots as auxiliary diagnostic tools for various fictional pulpal and periradicular disease cases. These cases had been previously assessed by experienced dentists, allowing the authors to compare and analyze the diagnostic accuracy and treatment recommendation performance of four different artificial intelligence chatbots. The results indicated that two of the chatbots demonstrated higher levels of diagnostic accuracy and more reliable treatment recommendations. The study concluded that artificial intelligence chatbots could serve as valuable auxiliary diagnostic tools for interpreting complex cases. However, the authors emphasized the necessity of dentist oversight, as chatbot responses are not yet consistently reliable.

We would like to thank the authors for their interest in our paper. Additionally, we believe it is important to clarify several points regarding the use of artificial intelligence chatbots, not only in the context of pulpal and periradicular disease cases but also in other fields of dentistry, which may influence the conclusions drawn by Mendonça de Moura *et al.*, 2023. Artificial intelligence emerged as a promising tool in the mid-2010s during the Fourth Industrial Revolution, alongside technologies such as machine learning, advanced robotics, and 3D printing. This shift was driven by the growing demand for automation and the integration of cutting-edge technologies in the industrial sector (Kalra *et al.*, 2024). The primary goal was to enhance productivity through digitized processes and automated tasks. Fundamentally, artificial intelligence involves training computers to perform calculations, handle routine tasks, analyze vast amounts of data, identify patterns, and provide timely diagnoses.

In essence, artificial intelligence development is rooted in two primary branches: machine learning and deep learning. Machine learning refers to systems that can be trained using various techniques and problem-solving models, enabling them to automate task execution (Bonny *et al.*, 2023). Deep learning, a subset of machine learning, focuses on modules based on artificial neural networks, driving continuous advancements in artificial intelligence. Consequently, artificial intelligence applications have expanded far beyond industrial settings, including into fields like medicine and dentistry.

In the field of dentistry, artificial intelligence has emerged as an increasingly valuable tool for enhancing clinical diagnoses, with the goal of providing patients with the highest standard of care and improving the likelihood of achieving excellent clinical outcomes. Although dentists are trained during their academic education to analyze clinical data, make diagnostic assessments, and recommend optimal treatment plans, factors such as educational background, years of practice, and clinical experience can significantly affect the accuracy of diagnoses, treatment planning, and implementation. These variables may occasionally result

[1] Post-Graduate Program in Clinical Dentistry, University Center of State of Pará, Belém, Pará, Brazil.
[2] School of Dentistry, University Center of State of Pará, Belém, Pará, Brazil.

in suboptimal patient outcomes (Ntovas *et al.*, 2024; Shen *et al.*, 2022).

Despite its potential, there remains a significant lack of clinical and comparative studies investigating the effectiveness of artificial intelligence and evaluating its role in dentistry. While numerous literature reviews have explored the theoretical applications of artificial intelligence in dental practices, there is limited focus on its practical use in clinical decision-making. For example, the study by Mendonça de Moura *et al.* 2023, specifically analyzed the performance of chatbots in diagnosing pulpal and periradicular conditions. However, dentistry is far more complex and diverse, encompassing a wide range of specialties beyond pulpal and periradicular diagnoses, such as endodontics, restorative dentistry, implantology, and periodontics.

These specialties often require detailed analysis of clinical and radiographic data, demanding technical expertise and experience. Artificial intelligence holds immense potential to augment professionals in these areas by enhancing diagnostic accuracy, reducing human error, and improving standardization. With technological advancements, artificial intelligence is increasingly being explored for integration into dental practices. For instance, advanced chatbots could support dentists by addressing diagnostic inconsistencies and improving the reliability and precision of results, ultimately enhancing patients' quality of life (Deng *et al.*, 2024).

Given the demonstrated capabilities of artificial intelligence systems, one may question whether chatbots and similar technologies are being underutilized or insufficiently studied within the broader scope of dentistry. By limiting the focus to specific diagnostic areas, there is a risk of overlooking the transformative potential of artificial intelligence across the full spectrum of dental practice. Expanding research to include other applications of artificial intelligence could unlock new opportunities for its integration and maximize its impact in dentistry.

Artificial intelligence tools, including advanced chatbots, are no longer futuristic concepts but readily available resources, with many offerings free versions accessible to all. Despite their potential, their adoption in dentistry remains limited, often hindered by misconceptions, hesitation, or a lack of understanding about their practical applications. This hesitation underscores the importance of disseminating knowledge about these technologies and their appropriate use.

Successful integration of artificial intelligence tools in dental practice requires not only familiarity with their capabilities but also the ability to tailor prompts to align with the specific clinical tasks at hand. Proper training and prior knowledge are essential to maximize the accuracy and reliability of these systems while ensuring that they complement, rather than replace, the critical expertise of the dentist. We encourage the dental community to embrace these advancements and invest in further exploration of their applications. By doing so, we can demystify their use, overcome barriers, and unlock their potential to enhance diagnostic precision, streamline decision-making, and ultimately improve patient care.

Ethics Statement. We authors recognize this review paper is a letter to the editor upon a previous published paper, therefore no need for human ethical committee submissions.

REFERENCES

Bonny, T.; Al Nassan, W.; Obaideen, K.; Al Mallahi, M.N.; Mohammad, Y.; El-Damanhoury, H.M. Contemporary role and applications of artificial intelligence in dentistry. *F1000Res., 20*:1179, 2023.

Deng, K.; Zonta, F.; Yang, H.; Pelekos, G.; Tonetti, M.S. Development of a machine learning multiclass screening tool for periodontal health status based on non-clinical parameters and salivary biomarkers. *J. Clin. Periodontol., 51*:1547-60, 2024.

Kalra, N.; Verma, P.; Verma, S. Advancements in AI-based healthcare techniques with focus on diagnostic techniques. *Comput. Biol. Med., 179*:108917, 2024.

Mendonça de Moura, J.D.; Fontana, C.E.; Reis da Silva Lima, V.H.; de Souza Alves, I.; de Melo Santos, P.A.; de Almeida Rodrigues, P. Comparative accuracy of artificial intelligence chatbots in pulpal and periradicular diagnosis: A cross-sectional study. *Comput. Biol. Med., 183*:109332, 2024.

Ntovas, P.; Marchand, L.; Finkelman, M.; Revilla-León, M.; Att, W. Accuracy of manual and artificial intelligence-based superimposition of cone-beam computed tomography with digital scan data, utilizing an implant planning software: A randomized clinical study. *Clin. Oral Implants Res., 35*:1262-272, 2024.

Shen, K. L.; Huang, C. L.; Lin, Y. C.; Du, J. K.; Chen, F. L.; Kabasawa, Y.; Chen, C. C. *et al*. Effects of artificial intelligence-assisted dental monitoring intervention in patients with periodontitis: A randomized controlled trial. *J. Clin. Periodontol., 49*:988-98, 2022.

Corresponding author:
João Daniel Mendonça de Moura
University Center
State of Pará
9 de Janeiro, Nazaré
Belém
PA 66060-575
BRASIL

E-mail: joao.moura@prof.cesupa.br