Letter to Editor
ISSN 2645-4351
https://doi.org/10.22037/jds.v43i1.47337

Enhancing Oral Health: The Impact of Artificial Intelligence in Dentistry

Shahab Kavousinejad [a,*]

[a]Department of Orthodontics, Dentofacial Deformities Research Center, Research Institute of Dental Sciences, School of Dentistry, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Correspondence to: Shahab Kavousinejad, Email: shahabkavousinejad@sbmu.ac.ir

I am writing to discuss the exciting advancements in the field of dentistry brought about by artificial intelligence (AI). The integration of AI technologies, particularly machine learning and deep learning, is revolutionizing dental practice by enhancing diagnostic accuracy, streamlining treatment planning, and improving patient management. As AI continues to evolve, it offers innovative solutions to longstanding challenges, such as variability in diagnostic accuracy and efficiency in clinical workflows.

One of the most significant applications of AI in dentistry lies in diagnostic imaging. AI algorithms, especially those based on deep learning, have shown remarkable capabilities in analyzing dental radiographs and identifying conditions such as dental caries and periodontitis. For example, studies indicate that convolutional neural networks (CNNs) can achieve impressive accuracy in detecting dental caries from periapical radiographs, significantly enhancing early diagnosis compared to traditional methods.[1, 2, 3] Additionally, AI systems have been developed for classifying dental implants, with reported accuracies ranging from 0.63 to 0.96. This capability not only aids in treatment planning but also enhances patient outcomes.[4, 5]

Moreover, the role of AI extends beyond diagnostics. It plays a crucial part in treatment planning and patient management. AI-driven tools can automate routine tasks such as appointment scheduling and treatment coordination, thus allowing dental professionals to devote more time to direct patient care.[6, 7] Furthermore, AI facilitates the customization of dental appliances and treatment plans through patient-specific simulations, significantly enhancing the precision of interventions.[8] This feature is particularly beneficial in pediatric dentistry, where tailored approaches are essential to meet the unique needs of children.[8]

However, while the advancements in AI are promising, the implementation of these technologies in dentistry is not without challenges. Concerns surrounding data security, ethical considerations, and the necessity for robust validation of AI systems are prevalent.[9] The inherent variability in dental imaging and the complexity of dental conditions require extensive validation across diverse cases to ensure AI can reliably support clinical decision-making.[10] Importantly, the integration of AI must complement the expertise of dental professionals rather than replace it, highlighting the importance of a collaborative approach in leveraging AI technologies.[7, 11]

In conclusion, AI is positioned to revolutionize the field of dentistry by enhancing diagnostic accuracy, optimizing clinical workflows, and personalizing patient care. However, ongoing research and careful consideration of ethical implications are essential for fully realizing the benefits of AI in this domain. As technology progresses, it is crucial for dental professionals to actively engage with these advancements, ensuring that AI serves as a valuable tool in improving oral healthcare.

References

1. Ahmed N, Abbasi M, Zuberi F, Qamar W, Halim M, Maqsood A, et al. Artificial intelligence techniques: analysis, application, and outcome in dentistry—a systematic review. Biomed Res Int. 2021;1-15. doi:10.1155/2021/9751564
2. Anil S, Sudeep K, Saratchandran S, Sweety VK. Revolutionizing dental caries diagnosis through artificial intelligence. 2023.; chapter: 3. doi:10.5772/intechopen.112979
3. Anil S, Porwal P, Porwal A. Transforming dental caries diagnosis through artificial intelligence-based techniques. Cureus. 2023;15(7):e41694. doi: 10.7759/cureus.41694
4. Chen ID, Yang CM, Chen MJ, Chen MC, Weng RM, Yeh CH. Deep learning-based recognition of periodontitis and dental caries in dental x-ray images. Bioengineering; 10(8):911. doi:10.3390/bioengineering10080911
5. Hwang JJ, Jung YH, Cho BH, Heo MS. An overview of deep learning in the field of dentistry. Imaging Sci Dent. 2019;49(1):1-7. doi:10.5624/isd.2019.49.1.1
6. Kohlakala A, Coetzer J, Bertels J, Vandermeulen D. Deep learning-based dental implant recognition using synthetic x-ray images. Med Biol Eng Comput. 2022;60(10):2951-2968. doi:10.1007/s11517-022-02642-9
7. Kuruva SD, KVK SK, Senapathi NB. Artificial intelligence in pediatric dentistry. Academia J Med;7(1):1-5. doi:10.62245/ajm.v7.i1.1
8. Musri N, Christie B, Ichwan SJA, Cahyanto A. Deep learning convolutional neural network algorithms for the early detection and diagnosis of dental caries on periapical radiographs: a systematic review. Imaging Sci Dent. 2021;51(3):237–42. doi:10.5624/isd.20210074
9. Salli G, Alagoz E, Gursoy N, Sarica İ. Artificial intelligence in maxillofacial radiology: a bibliometric study. Mathews J Dentistry. 2023; 7(1):33. doi:10.30654/mjd.10033
10. Schwendicke F, Samek W, Krois J. Artificial intelligence in

dentistry: chances and challenges. J Dent Res
. 2020;99(7):769-74. doi:10.1177/0022034520915714
11. Sukegawa S, Yoshii K, Hara T, Yamashita K, Nakano K, Yamamoto N, et al. Deep neural networks for dental implant system classification. Biomolecules. 2020;10(7):984. doi:10.3390/biom10070984