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ARTIFICIAL INTELLIGENCE IN THERAPEUTIC DECISION-MAKING FOR COMPLEX DENTAL DISEASES: A REVIEW

Das A.C.[1]*, Samir P.V.[2], Khan S.H.[3], Fernandes B.[4], Arya A.[5], Mustafa M.[6]

[1.] Institute of Dental Sciences, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar, Odisha, India
[2.] Kalinga Institute of Dental Sciences, KIIT Deemed to be University, Bhubaneswar, Odisha, India
[3.] Maharashtra Public Health Services, Mumbai, Maharashtra, India
[4.] Faculty of Dentistry, SEGi University, Selangor, Malaysia
[5.] Department of Conservative Dental Sciences, College of Dentistry, Prince Sattam bin Abdulaziz University, Al-Kharj, Saudi Arabia.
[6.] Centre for Transdisciplinary Research, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India.

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Abstract

Introduction: *The expanding complexity of dental diseases has exposed the limitations of conventional heuristic-based therapeutic planning. Artificial Intelligence (AI) has evolved beyond diagnostic assistance to become a powerful tool in therapeutic decision-making, enabling data-driven, predictive, and personalized dental care.*

Material and Methods: *This narrative review critically evaluates contemporary applications of artificial intelligence in therapeutic planning, prognostic assessment, and surgical execution across major dental specialties, including periodontology, endodontics, prosthodontics, orthodontics, and implantology. Evidence from machine learning, deep learning, computer vision, and robotics-based systems was synthesized to assess clinical relevance beyond diagnostic accuracy.*

Results: *Artificial intelligence-based clinical decision support systems demonstrated improved precision in treatment planning, outcome prediction, and procedural execution. Applications such as generative prosthetic design, Artificial intelligence -guided endodontic access, implant navigation, orthodontic treatment simulation, and robotic-assisted surgery showed potential to reduce operator variability and enhance therapeutic outcomes. However, challenges related to data heterogeneity, algorithmic bias, explainability, and medico-legal accountability persist.*

Conclusion: *Artificial Intelligence is redefining therapeutic decision-making in dentistry by augmenting clinical judgment rather than replacing it. When integrated within a human-in-the-loop framework, artificial intelligence serves as a high-level therapeutic assistant capable of improving accuracy, efficiency, and personalization of dental care. Future research must prioritize longitudinal clinical validation and ethical governance to enable safe and effective clinical translation.*

Keywords: *Artificial Intelligence; Therapeutic Decision-Making; Clinical Decision Support Systems; Precision Dentistry; Robotics; Generative Design*

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Address for Correspondence:

Mohammed Mustafa; BDS, MDS, MFDS RCPS(Glasg), FDS RCS(Eng), Professor
Department of Conservative Dental Sciences College of Dentistry, Prince Sattam Bin Abdulaziz University Al-Kharj 11942, Saudi Arabia
Tel.: +91 (9987697896)
E-mail: ma.mustafa@psau.edu.sa