EDITORIAL

Artificial Intelligence in Dentistry: Hype or Hope?

Ulfat Bashir, Kanwal Zulfiqar

Artificial intelligence is one of the most significant contributions to the fourth industrial revolution, which ushers in a new digital era. It is defined as “the study of intelligent agents, which includes any machine that can comprehend its environment and respond to increase its chances of success.”[1] The term "AI" is used informally when a machine imitates cognitive processes that people often connect with other human minds, such as "learning and problem-solving."[1] Mathematician John McCarthy created the concept of "artificial intelligence" in 1955. McCarthy is widely considered the founder of the field. To explain how machines might be able to perform what can be referred to as "intelligent" activities, he introduced this phrase.[2] Numerous industrial sectors, including robotics, transportation, smart cities, financial analysis, etc., have incorporated AI. As an example, medical and dental imaging diagnostics, decision support, precision and digital medicine, drug discovery, wearable technologies, hospital monitoring, robotic and virtual assistants have all been employed in medicine and dentistry. In many instances, artificial intelligence (AI) can be seen as a helpful tool for physicians and dentists to lessen their labor. AI may learn from various information sources (multi-modal data) to diagnose diseases beyond the capability of humans, in addition to identifying diseases by means of a single information source that is focused on a particular illness.[3]

The introduction of AI platforms such as CHAT GPT has completely revolutionized the dynamics of information being available within seconds. Similarly, health professionals are eagerly contemplating its effects in the Medical and Dental Health profession.[3] The dentists all over the world are also rapidly embracing the advancements in AI and machine learning.[4] One of the biggest advantages of AI in dentistry is its ability to diagnose oral diseases with high accuracy and precision. AI algorithms can analyze dental images and detect early signs of oral cancer, periodontitis, and other oral diseases, allowing for early treatment and prevention of further complications.[5]

AI has been heavily utilized in periodontology to investigate, comprehend, and build periodontal applications, such as detecting periodontal bone loss, identifying gingivitis inflammation, and evaluating connective tissues and other periodontal cavities.[4] Endodontic treatment planning has been greatly aided by AI in recent years. Different types of AI can aid dentists in the diagnosis and management of endodontic issues while fostering performance and assuring improved and precise patient care. The review's main objectives are to extract and evaluate AI-based methods for disease diagnosis and therapy planning.[4]

When teeth exhibit periapical lesions and/or associated symptoms, it may be challenging for doctors to make a diagnosis and formulate a treatment plan.[6] The common disease known as apical periodontitis is responsible for about 75% of cases with radiolucent jaw lesions.[7] Early detection could improve the effectiveness of care, stop it from spreading to other tissues, and lessen potential difficulties.[8] Another benefit of AI in dentistry is its ability to improve the planning and execution of dental procedures.[5] AI algorithms can help dentists plan complex procedures such as implants, orthodontics, and restorations with high accuracy, reducing the risk of complications and ensuring the best possible outcome for the patient.[4]

Due to its capacity to improve the efficiency and accuracy of the diagnostic process, artificial intelligence (AI) has become extremely popular in orthodontics in recent years. Since orthodontic treatments are frequently drawn-out processes, more effective planning calls for more effective and efficient solutions. Dentists can make judgments more precisely and quickly in a time-constrained context by using AI-based knowledge to automate disease diagnosis and treatment prognosis processes. Through their capacity to learn and make

Department of Orthodontics
Islamic International Dental College,
Riphah International University Islamabad

Correspondence:
Prof. Ulfat Bashir
Department of Orthodontics
Islamic International Dental College,
Riphah International University Islamabad
E-mail: ulfat.bashir@riphah.edu.pk

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automobile decisions, AI solutions can further aid in the prevention of human errors. Numerous studies have looked into using AI to diagnose and design treatments for orthodontic diseases.[9,10]

In the area of dental education, AI is extensively used. The preclinical virtual patient input to the students has been much enhanced. The interactive interphase develops top-notch learning environments by letting pupils assess their own work and contrast it with the ideal. Numerous studies on the efficiency of these systems have revealed that, in comparison to conventional simulator units, these systems enable students to reach a competency-based skill level more quickly.[11] Artificial intelligence-powered virtual dental assistants can perform a variety of tasks in dental offices with greater accuracy and fewer errors. It is very helpful when discussing the patient's medical history and any habits they may have, such as smoking and drinking, with the dentist. The patient can choose to receive urgent teleassistance in dental crises, particularly if the practitioner is not readily available.[12]

In recent years, there has been a noticeable increase in the number of research investigating the application of AI in restorative dentistry.[13,14] Various studies investigated the application of AI in helping caries detection, vertical tooth fracture prediction, and treatment planning. To accurately plan therapy utilizing clinical examples, Lee et al. suggested a machine learning method based on a decision tree to evaluate the tooth prognosis. The model's precision was 84.1%.[13]

However, despite the rapid progress made in AI research in dentistry, there are still many challenges that need to be addressed. One of the biggest challenges is the lack of data standardization and interoperability between AI systems and existing dental systems. Also there is lack of understanding and adoption by dental professionals. While some dentists have embraced AI and its benefits, others are still skeptical about the technology and its ability to replace human expertise. Additionally, the high cost of AI technology can also limit its widespread adoption, particularly in resource-limited settings like Pakistan. This can lead to the inability to share data and collaborate on research thus limiting the advancement of the field. Additionally, there is a need for further research on the ethical and legal implications of AI in dentistry, such as data privacy and patient consent.

It is still necessary to use appropriate external data gathered from freshly enrolled patients or gathered from other dental facilities to confirm the generalizability and dependability of the offered AI models, even though their results have been encouraging.[15] Administration and exchange of clinical data are two major barriers to the use of AI systems in the healthcare sector. Patients' personal data is needed for both the initial training of AI algorithms as well as for ongoing training, validation, and improvement. The development of AI will also promote data sharing across multiple institutions and, in some circumstances, across international borders. AI must be integrated into healthcare operations while modifying systems that protect patient confidentiality and privacy.[16] Personal data must therefore be anonymized before considering a wider distribution.[17] Even if these protections are technically possible, the medical community has doubts about secure data sharing.

Despite these limitations, the future of AI in dentistry looks bright. As AI technology continues to advance and become more accessible, we can expect to see an increased adoption of the technology by dental professionals and patients alike. Furthermore, the development of AI-powered devices and tools will revolutionize the way dentists diagnose and treat oral diseases, leading to improved patient outcomes and a more efficient and effective delivery of dental care. computer learning Researchers will be better able to comprehend some multifactorial diseases with the aid of deep learning, and it will be feasible to increase our collective understanding of oral diseases and conditions that are not yet fully known. Artificial intelligence can undoubtedly be a tool for delivering improved healthcare to patients, but it cannot in any way take the place of human knowledge, skills, and capacity of judgment.[18]

Despite the difficulties, there is a good probability that AI will be used in dentistry in the future, and as we adopt these exciting innovations, patient care will only improve. However, for this to happen in the dental sector, new finance resources are required, along with debt and an understanding that open systems lead to innovations that are good for the sector. The possibilities are endless if these problems can be fixed. In conclusion, AI is the next paradigm shift in the healthcare. We as healthcare

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professionals need to carefully evaluate the challenges we face when moving towards this new age of transformation.AI is not absolute and cannot replace human judgement. It is imperative that we adapt to AI to improve patient care but also be watchful of its limitations.

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CONFLICT OF INTEREST

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DATA SHARING STATMENT

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