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EDITORIAL **OPEN ACCESS**

Artificial Intelligence & Dental Healthcare: Current Status and Future Challenges

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1. INTRODUCTION

Artificial Intelligence (AI) is the development of computer systems capable of learning and solving problems like human beings. Generative AI (Gen AI) now bridges the usability gap in AI by providing a natural language interface for interacting with complex models [1]. Gen AI can generate original text, images, and even videos in response to users' requests. The Gen AI is mainly built on machine learning and deep learning.

As the storm of the AI revolution spreads worldwide, the healthcare sector has been drawn into the vortex of rapid technological change over the past 10 years. AI-assisted systems allow clinical practitioners to solve problems that once were the realm of sci-fi. The following discussion is a brief review of AI use in healthcare across some medical and dental areas over the past decade, drawing the reader's eye closer to the thrive-and-shine story of AI application. Nevertheless, AI could be a 'disruptive' technology, and appropriate measures should be implemented to enhance technological governance and ensure that AI-assisted healthcare can navigate the future challenges [2].

When IBM's AI system Watson won the television game show Jeopardy in 2011, we realized that the significant benefits and perceived disruption from AI applications were on the immediate horizon. Watson has been groomed to do more serious work in healthcare, particularly in diagnosing diseases. An AI such as Watson has enormous potential advantages over human doctors [3].

Another attention-grabbing story is the breakthrough made by Elsevier in building AI tools to provide not only the diagnosis but also medical solutions for patients. Elsevier, a global multimedia publishing company, gave serious consideration to using its vast medical data to build AI tools for healthcare purposes. Elsevier succeeds. It has built an advanced clinical decision support platform, which uses natural language processing and machine learning to suggest the optimal treatment pathways for patients. The platform uses anonymized patient data, including medical histories, treatment histories, and outcomes. It uses a database of five million medical insurance claims. It also includes almost all articles published in its journals over the last 140 years [4].

The success stories of some European countries in actually incorporating AI models into their healthcare systems for disease diagnosis should also be brought into the spotlight. For instance, Sweden and Finland are already using AI solutions to help healthcare providers detect cancer at an early stage. These applications can also be found in Germany. In the UK, Imperial College London is using AI to develop a diagnostic tool for tuberculosis [5].

It is an unassailable fact that China is among the countries that have incorporated AI models into its

healthcare systems. For example, an AI-empowered hospital opened in Wuzhen, Zhejiang Province, in late 2023. Another AI medical model developed by a team in Shanghai has successfully passed the national medical licensing examination. On the clinical front, work is underway to harness Generative AI to reduce doctors' administrative burdens [6]. As China seeks new solutions to the challenges posed by an aging population and disparities in access to medical resources, more hospitals are expected to incorporate AI technology into their healthcare systems [7].

Just like in other fields of medicine, AI is also rapidly transforming the practice of clinical dentistry. A comprehensive White Paper was published by the American Dental Association in 2022, and we can see that the scope of AI-related dental work is broad and continues to expand. AI technology can assist dentists in diagnosis and treatment planning in cariology [8], endodontics [9], implant dentistry [10], orthodontics [11], oral and maxillofacial surgery, periodontology, and in the prediction of treatment prognosis to a certain extent. AI has significantly improved diagnostic accuracy and enhanced efficiency in orthodontics, prosthodontics, and implantology by optimizing treatment simulation, material selection, and surgical precision [12].

Personalized education and improved communication with patients can also be achieved with the use of AI [13]. With AI, patient care can also be enhanced using teledentistry for people living in remote areas with limited access to dental professionals [14]. For the dental patients, case acceptance is also more favorable when AI technology is used for discussion of findings and possible treatment plans [15].

However, we have to understand the limitations of AI technologies. For example, understanding patients' concerns, measuring the probing depth of periodontal pockets, taking accurate images, and radiographs would still need to be carried out thoroughly by the clinician. It is still not clear whether AI could truly provide personalized dental medicine because of the limitations of current algorithms and the data provided [16]. On the other hand, AI still cannot replace a comprehensive literature search and analysis for authors preparing a manuscript on implant treatment [17]. Although the use of robotics with AI in endodontics is also showing promising outcomes [18], the costs for installation and maintenance are high. Given the high success rates of endodontic treatments using conventional techniques, the development of AI in this area may not bring us significant cost-effectiveness. And more importantly, it would still require the utmost scrutiny by a clinician to determine if the diagnoses and treatment options are logical and to reject the recommendations when necessary.

AI gives clinicians the opportunity to make diagnoses and treatment plans with high efficiency and accuracy, but there are still many challenges. These include patient acceptance, legal liability, and training of dental personnel [19]. The ultimate and biggest challenge for scientists, engineers, and dental healthcare professionals would probably be the integration of AI into robotic dentistry to provide operative treatments without human intervention.

There is no doubt that AI is set to become one of the biggest economic drivers in the medical technology space over the next few years. But AI is a double-edged sword. In view of the economic benefits AI technology brings to our healthcare systems and the unstoppable momentum of the AI revolution, guardrails should be put in place to strengthen technological governance for the well-being of our patients.

CONCLUSION

Last but not least, high-quality data remains essential for any AI system to 'learn', and rigorous research will continue to be paramount.

AUTHOR'S CONTRIBUTIONS

The author confirms sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

ABBREVIATION

AI = Artificial Intelligence

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None.

CONFLICT OF INTEREST

The author declares no conflict of interest, financial or otherwise.

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