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Glimpse into the future of prosthodontics: The synergy of artificial intelligence

Artak Heboyan, Nazia Yazdanie, Naseer Ahmed

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Abstract

Prosthodontics, deals in the restoration and replacement of missing and structurally compromised teeth, this field has been remarkably transformed in the last two decades. Through the integration of digital imaging and three-dimensional printing, prosthodontics has evolved to provide more durable, precise, and patient-centric outcome. However, as we stand at the convergence of technology and healthcare, a new era is emerging, one that holds immense promise for the field and that is artificial intelligence (AI). In this paper, we explored the fascinating challenges and prospects associated with the future of prosthodontics in the era of AI.

Key Words: Artificial intelligence; Prosthodontics; Treatment planning; Patient-centric care; Three-dimensional printing

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Core Tip: Prosthodontics and artificial intelligence working together will raise the standard of dental care in the twenty-first century and improve the quality of life for many people who require dental replacements.

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INTRODUCTION

Artificial intelligence (AI) has transformed diagnoses in healthcare, including the prosthodontics field[1-3]. Machine learning (ML) algorithms can evaluate exponential patient data, such as patient interviews, radiographs, and intraoral scans to detect oral diseases early with a high accuracy[4]. AI can help prosthodontists discover oral conditions earlier, allowing them to intervene rapidly and deliver highly effective treatments[5]. Furthermore, AI-powered treatment planning can improve decision-making in prosthodontic procedures. AI can offer customized treatment plans by analyzing patient-specific data, ensuring that prosthetic solutions are matched to the individual needs. This improves not just patient satisfaction but also treatment efficacy[3,6].

While AI generally involves the application of advanced algorithms and ML technologies to complete tasks that would typically require human intelligence. ML in medicine particularly refers to the use of algorithms that can acquire information from data to improve performance on a certain task. This maybe acquired from huge datasets involve teaching models, patient histories or medical photographs to recognize configurations and associations that would be challenging for individuals to distinguish. ML can be applied for a variety of healthcare applications including treatment outcomes prediction, patients' possible medical conditions identification, or treatment plans optimization[7,8].

The future of prosthodontics will be characterized by a shift towards greater customization[2]. AI algorithms can analyze a patient's unique oral anatomy and recommend the most suitable materials, designs, and manufacturing techniques for prosthetic devices. This level of personalization ensures that patients receive prostheses that fit seamlessly, enhancing comfort and functionality[9]. Furthermore, the integration of AI with three-dimensional printing technology allows for the rapid fabrication of complex dental prosthesis. This combination enables the fabrication of precise crowns, bridges and dentures. As a result, prosthodontists would provide rapid, cost-effective, and aesthetically acceptable solutions to their patients[10].

The chatbots and virtual assistants driven by AI are already revolutionizing patient interaction in healthcare. These technologies in prosthodontics can give patients with information, support, and appointment reminders. AI-powered tele-prosthodontics services can offer remote consultations and follow-ups, increasing access to dental treatment for people living in distant or underserved areas[11,12]. Furthermore, AI can improve the patient experience by anticipating and resolving potential issues before they arise. Prosthodontists can offer pro-active interventions and recommendations by continuously monitoring and analyzing patient data, assuring the long-term success of prosthetic treatment[13].

While the future of prosthodontics with AI holds immense promise, it also presents several challenges and ethical considerations. Ensuring data privacy, security, and informed consent are crucial aspects of integrating AI into healthcare [14]. Taking into consideration that patient records are mostly confidential, there is an expected disagreement among organizations to exchange patients' medical data and personal information. AI systems raise some significant concerns regarding data safety and privacy. Since health-related data are significant and vulnerable, hackers sometimes can target them, thus, preserving the privacy of medical data is crucial. Patient informed consent is another key factor for data confidentiality since healthcare specialists may permit widespread usage of patient medical data for AI research without demanding patient consent[15,16]. Moreover, there is a need for rigorous training and education to equip prosthodontists with the skills required to harness the power of AI effectively.

Finally, there are possible threats to healthcare providers and humans connected to potential misuse of AI-systems. Limitations in the use of AI in dentistry may be related to lack of transparency and accountability as well as bias and discrimination. AI-based systems may be inadequate in their understanding of the context of human oral health and disease. Nowadays, job displacement is not a significant shortcoming of AI application in dentistry, especially for prosthodontics, but it is likely that some procedures could be replaced by AI devices. However, AI systems may not be available or affordable to all human beings and communities, which may lead to discriminations in access to healthcare [16,17].

CONCLUSION

AI will open up new possibilities for prosthodontics and take it into unexplored landscape. Dental prosthetic solutions will soon be more precise and available than ever due to AI-powered diagnostics, treatment planning, customization and patient-centered care. It is crucial to keep an eye out for emerging ethical and regulatory issues as we proceed along this transformational route. Prosthodontics and AI working together will raise the standard of dental care in the twenty-first century and improve the quality of life for many people who require dental replacement and rehabilitation.

FOOTNOTES

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