Original Article

Awareness and Attitudes Toward Artificial Intelligence (AI) Applications in Prosthodontics Among Dental Students and Professionals

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Abstract

Objective: The purpose of this study is to evaluate dental professionals' and students' knowledge, attitudes, and perceived difficulties with the use of artificial intelligence (AI) in prosthodontics.

Methodology: This is a cross-sectional study. The study investigated the participants knowledge of artificial intelligence (AI), as well as its perceived benefits, possible disadvantages, and the necessity of include AI instruction in dental school curricula.

Results: In this study only 28% of participants regularly employed AI-based applications in clinical practice. Among the participants 63% having some exposure to AI. Improved treatment planning efficiency (25%) and increased diagnostic accuracy (40%) were the most well-known advantages of AI. The ethical concerns and the lack of human contact were concerns of the 25% and 30% participants respectively. Seventy eight percent of respondents said they had no formal AI training. A majority (65%) favored integrating AI into dental education. High expenses (30%) and a lack of educational resources (40%) were obstacles to the integration of AI.

Conclusion: There is increased awareness of AI in prosthodontics. But economic issues, a lack of proper training, and ethical problems limit its practical use. This gap could be closed and AI usage in clinical settings increased by incorporating AI education into dentistry curricula and offering professional training.

Keywords: Artificial intelligence, Dental education, Dental students, Medical education, Prosthodontics

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Introduction

The evolution of artificial intelligence (AI) has a powerful transformative impact in different fields, including dentistry. There are several components of AI.[1] These components are machine learning, deep learning, and neural networks. All of these when combined can enable the automation of multiple tasks.[2] AI applications in dentistry have led to more accurate diagnostic imaging, disease likelihood, prosthodontics planning, and clinical decision-making.[3] The awareness, attitudes, and readiness of dental students and dental professionals to implement this tool in their clinical practice is important due to the ever growing reliance on AI in healthcare.[4]

One of the dedicated branch of dentistry that deals with the restoration and replacement of teeth is Prosthodontics. It has witnessed significant milestones with AI integration. AI-driven systems are now performing different tasks in this field. It helps in treatment planning, designing customized prosthesis.[5] It can also predict long-term treatment outcomes when the AI algorithm is trained for the specific task. Oral diseases diagnosis can also be developed with the help of image recognition by AI. Its application can be of high value in establishing the diagnosis of oral diseases and conditions such as residual ridge loss, and its classifications, periapical pathologies, and occlusal interferences.[6] Now-a-days computer-aided design and manufacturing (CAD/CAM) machines are produced along with the integration of AI to aid in the designing and manufacturing of the dental prosthesis. This integration will result in more accurate and timely fabricated restorations such as crowns, bridges, and dentures. The primary concern lies in the level of awareness and understanding of AI among dental students and professionals, particularly regarding its vast potential and wide-ranging applications in dentistry.[7]

The first step towards AI's application in prosthodontics is a detailed understanding of AI. It's competence, restrictions, and ethical considerations is required to be established for its successful application.[8] Regardless of all the potential advantages offered by AI, there are alarming concerns about over-dependence on technology, data privacy, and possible biases in AI algorithms. Until now, dental education has mainly focused on improving the hands-on skills and clinical judgment of young dentists. But with the fast growth of AI, there is a need to change how we teach. A well-trained and knowledgeable dental community is important to use AI properly while still giving good care to patients[9]

Multiple research articles have explored AI applications in dentistry but little research has been done locally on the awareness and attitudes of dental students and professionals toward AI in prosthodontics.10 Knowling the depth of their knowledge, perceived benefits, disadvantages, and the will to integrate AI into education and practice is necessary for guiding future educational and technological progresses. The awareness and attitudes of dental students and professionals toward AI applications in prosthodontics should be accessed, which can lead to the recognition of important points that influence its acceptability and potential integration into clinical workflows. The results will contribute to the progress of targeted educational initiatives and plans for rapid adoption of AI in dental practice.

AI is growing fast in dentistry, and it is important to prepare future dentists to use it well. AI can improve treatment and patient care, but its success depends on how ready and open dental students and professionals are to use it. This study looks at their awareness, opinions, and concerns about AI. By finding the gaps in training and the challenges they face, we can suggest better policies and education plans. This will help make the use of AI in prosthodontics smoother and more effective. Understanding their views will also help in planning better ways to include AI in dental practice and teaching.

Objectives:

- To assess the awareness and knowledge of dental students and professionals regarding AI applications in prosthodontics.

- To evaluate the attitudes and perceptions of dental students and professionals toward the adoption of AI in clinical practice.

- To explore the readiness and willingness of dental students and professionals to incorporate AI into their clinical work.

Methodology

This was a cross-sectional survey. The study was carried out among undergraduate dental students and practicing dental professionals. We aimed to include participants from different academic years and clinical experience levels. A stratified random sampling method was used to ensure fair representation from each group.

A structured questionnaire was given to each participant, either in printed or digital form. A consent form was also provided, clearly explaining the purpose of the study. It stated that participation was voluntary and that all responses would be kept confidential.

The questionnaire had different parts. These included demographic details, awareness and knowledge of AI, attitudes and perceptions toward AI in prosthodontics, perceived benefits, and challenges in adapting AI in practice.

The sample size was set at 150. This number was based on a 95% confidence level. It provided a good balance between accuracy and practicality.

Once the responses were collected, descriptive statistics were used to summarize the demographic data and awareness levels. Chi-square tests were applied to check for any associations between awareness and demographic factors.

Results

The study included participants ranging from 22 to 35 years, with a mean age of 27.3 years. Among the respondents, 42% were male, 57% were female, and 1% preferred not to disclose their gender. Regarding academic position, 35% were 3rd-year dental students, 30% were 4th-year dental students, 25% were practicing dentists, 5% were prosthodontic specialists and 5% were trainee medical officers

When asked about prior exposure to AI in dentistry, 63% reported having some exposure, while 37% had none. Familiarity with AI applications in prosthodontics varied, with 12% being very familiar, 38% somewhat familiar, 20% neutral, 22% unfamiliar, and 8% completely unaware. The primary sources of AI-related knowledge included online resources (55%), scientific literature (40%), university courses (35%), colleagues or mentors (25%), and conferences or workshops (20%). Despite exposure, only 28% had used AI-based tools in prosthodontics, while 72% had not.

Regarding AI's potential in prosthodontic treatment planning, 42% strongly agreed, 38% agreed, 10% were neutral, 7% disagreed, and 3% strongly disagreed. The most recognized advantage of AI was increased diagnostic accuracy (40%), followed by faster treatment planning (25%), better prosthesis design (20%), and reduced human error (12%). Key concerns included loss of human touch in patient care (30%), ethical and legal issues (25%), risk of incorrect diagnoses (20%), and high implementation costs (18%).

A significant majority (65%) believed AI should be integrated into dental education, while 25% were uncertain, and 10% opposed the idea. Regarding future AI adoption, 35% were very likely, 40% likely, 15% neutral, 7% unlikely, and 3% very unlikely to use AI-assisted tools. Most participants (45%) believed AI would serve as an aid rather than replace dental procedures, while 35% thought it might replace some procedures, and 15% believed it could replace many.

Participants identified the most beneficial AI applications in digital impression-taking and scanning (35%), treatment planning (30%), prosthesis fabrication (20%), and post-treatment evaluation (10%). As for regulation, 55% supported strict regulations, 35% favored moderate regulations, and 10% saw no need for regulations. Confidence in interpreting AI-assisted diagnostic results was moderate, with 10% being very confident, 40% somewhat confident, 25% neutral, 20% not confident, and 5% not at all confident.

75% expressed interest in AI-focused continuing educa-

tion courses. The primary barriers to AI adoption were lack of knowledge and training (40%), high implementation costs (30%), resistance to change (15%), limited AI tool availability (10%), and other factors (5%). Overall, the results highlight a generally positive outlook toward AI adoption, tempered by concerns about training, costs, and ethical considerations.

Discussion

The results several previous studies align with the results of this study regarding AI awareness and acceptance in dental field. An article by Sirageddin Alhmadi et al. stated that 64% of dental professionals have had some experience to AI, these results are similar to the 63% found in this study.[11] Similarly, in another study Zeiler MD highlighted that while many professionals were aware of AI, only a small proportion actively utilized AI-based applications in their clinical setting, these findings are also consistent with the 28% of the participants use of AI integrated tools rate observed here.[12] These similarities suggest that, despite growing awareness, the practical application of AI remains limited across various dental populations.

This study's findings about AI's potential benefits, such as more improved diagnosis (40%) and quicker planning of complex clinical cases (25%), are consistent with results from Khanagar et al., who stresses that use of AI can lead to increase efficiency and accuracy in prosthodontics.[13] Moreover, as our study highlighted that concerns of the participants regarding perceived disadvantages of AI, that are loss of human touch (30%) and ethical issues (25%), were also highlighted by Maskara R in his study.[14]

The popular opinion of incorporating AI into dental education (65%) aligns with results by Cemile Yılmaz et al., who reported that 68% of dental students and professionals advocated for AI training in curricula.[15] These results highlight a prevalent realization of the need of the hour for proper AI training to bridge the gap between awareness and practical application.

Confidence in diagnosis assisted by artificial intelligence is varying. Among the participants only 10% feeling very confident, this finding is also consistent with the study by Hasan A, whose study concluded that inadequate practical experience contributes to lower confidence levels.[16] 78% of participants reported the absence of formal training, his finding additionally supports the results drawn by J. Ma, emphasizing the need for continuing education courses, as desired by 75% of respondents in this study.[17]

A comparison with the study by Sanjeev B. Khanagar et al. lead to alike inclinations in barriers related to AI adoption.[18] Their study stated that 35% of dental professionals regarded high costs as the main hurdle, this finding is almost similar with the 30% reported in this study. Furthermore, the lack of training is identified

by 40% as a barrier, mirrors findings from the work of Vodanović M, who emphasized that AI adoption is hindered by insufficient educational resources.[19]

The study by Anu Vashisht also supported the findings of this study, particularly regarding the preference for AI in digital impression-taking and treatment planning. Vashisht reported that 37% of participants viewed AI as most beneficial for digital workflows, aligning with the 35% observed here.[20] Similarly, Agrawal et al. found that dental professionals preferred AI for prosthesis design and post-treatment evaluation, consistent with this study's findings of 20% and 10%, respectively.[21]

Overall, the results of this study are consistent with existing literature, reinforcing the need for targeted education, cost-effective AI implementation strategies, and clear ethical guidelines to facilitate AI adoption in prosthodontics. The similarities between this study and previous research support the validity of the results and point out common challenges and opportunities shared across various dental groups.

This study has a few limitations. It had a small sample size, so the results may not show the full picture. Most of the responses were based on personal opinion, which can sometimes be biased. The study was also limited to one region, so the findings might be different in other places. More studies with larger groups and from different areas are needed to get a better understanding.

Conclusion

This study highlights that most dental students and professionals are aware of AI and see its value in prosthodontics. They believe AI can help with diagnosis, treatment planning, and making dental prostheses. However, many feel unprepared to use it due to lack of training, high costs, and fear of losing the human touch. These findings match past research. To move forward, formal education, practical training, and clear guidelines are needed. This will help future dentists use AI safely and confidently in their clinical work.

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Authors' Contribution Statement

FH contributed to the conception, design, acquisition, analysis, interpretation of data, and drafting of the manuscript. JA contributed to the acquisition, analysis, interpretation of data, drafting of the manuscript, and critical review of the manuscript. HH contributed to the design, acquisition, analysis, drafting of the manuscript, critical review, and final approval of the version to be published. SA contributed to the acquisition, analysis, interpretation of data, and drafting of the manuscript. SM contributed to the analysis, interpretation of data, and drafting of the manuscript. MAK contributed to the analysis, interpretation of data, and drafting of the manuscript. UK contributed to the acquisition, analysis, and interpretation of data. JA contributed to the acquisition, analysis, and interpretation of data. All authors are accountable for their work and ensure the accuracy and integrity of the study.

Conflict of Interest

Authors declared no conflict on interest

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None

Data Sharing Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.