Original Article

PERCEPTION OF DENTAL STUDENTS IN INCORPORATING ARTIFICIAL INTELLIGENCE INTO DENTAL EDUCATION

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Abstract:

Introduction: The study aimed to investigate the perception of dental students regarding the integration of artificial intelligence (AI) into dental education in Patna. The study sought to understand the students' attitudes, opinions, and expectations regarding the potential benefits and challenges associated with AI integration.

Methods: A cross-sectional survey was conducted among dental students from multiple dental schools. The survey questionnaire comprised items related to the students' perception of AI in dental education, including its potential advantages, concerns, and their level of preparedness to embrace AI technology. Data were collected and analysed using descriptive statistics and inferential analyses.

Results: A total of 128 dental students participated in the study. The results indicated that the majority of dental students had a positive perception of integrating AI into dental education. The awareness of AI in dentistry was reported in 48.6% of study respondents. The students expressed enthusiasm for AI-powered educational tools and virtual simulations, which they believed could augment their understanding of complex dental procedures and foster critical thinking.

Conclusion: Dental students generally exhibited a positive perception of integrating AI into dental education. These findings can guide dental educators and institutions in developing effective strategies for the integration of AI into dental curricula, addressing concerns, and maximizing the potential benefits of AI technology in dental education.

Key-words: *Dental Students, Diagnostic, Treatment Planning, Artificial Intelligence*

Introduction:

Artificial Intelligence (AI) has emerged as a transformative technology across various industries, including healthcare. (1) In dentistry, the integration of AI has the potential to revolutionize dental education by enhancing learning experiences, improving diagnostic accuracy, and optimizing treatment planning. As the field of dentistry continues to evolve, it becomes crucial to explore the perceptions and attitudes of dental students regarding the integration of AI into their educational curriculum. (2)

Dental education traditionally relies on didactic lectures, clinical training, and hands-on experiences to equip students with the necessary knowledge and skills. (3) However, the dynamic nature of healthcare demands continuous adaptation and incorporation of innovative technologies. AI, with its ability to process vast amounts of data, recognize patterns, and generate insights, holds promise in transforming dental education into a more efficient and effective learning environment. Understanding the perceptions of dental students towards the integration of AI in dental education is essential for successful implementation and acceptance of this technology. The attitudes and beliefs of students play a significant role in their engagement, adoption, and utilization of AI tools and techniques within their educational journey.(4)

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Understanding the perceptions of dental students on imparting AI to dental education is crucial for successful integration and utilization of this technology. By gaining insights into their attitudes and concerns, educators and policymakers can tailor curriculum design and implementation strategies to ensure an optimal learning experience that embraces the potential of AI in transforming dental education and practice. (5)

The current study aims to explore the perceptions of dental students regarding the imparting of AI in dental education. By examining their attitudes, expectations, and concerns, valuable insights can be gained to inform curriculum development, instructional design, and strategies for successful integration. Key areas of investigation in this study include the perceived benefits of AI in dental education, such as improved diagnostic accuracy, enhanced treatment planning, and more personalized patient care. Additionally, the study will explore potential challenges or reservations that dental students may have regarding AI, such as concerns about job security, ethical implications, or the need for additional training. By identifying the perceptions and concerns of dental students, this study can contribute to the development of effective strategies for incorporating AI into dental education. Furthermore, the findings can guide educators and policymakers in creating a supportive learning environment that fosters student engagement, prepares future dental professionals for the digital era, and maximizes the potential benefits of AI in dentistry.

Materials and Methods:

A cross-sectional survey made of qualitative interview was planned for the study. Dental students studying in Patna city, Bihar was chosen as the study population. Informed consent of all participating students was obtained. A convenience sampling technique was employed to incorporate study respondents. The mode of data collection was via a questionnaire (included as annexure) sent across as Google forms. A questionnaire was used to collect data on dental students' perception of incorporating AI into dental education that included demographic questions (e.g., age, gender, academic year) to gather relevant information about the participants. A section was designed to include questions that explored the participants' knowledge, attitudes, and opinions regarding AI in dental education. A pilot test of the questionnaire was done to ensure clarity and relevance. The questionnaire was circulated to the dental students. The data collected was analysed using appropriate statistical or qualitative analysis techniques. Quantitative analysis involved descriptive statistics, such as frequencies and percentages.

Results:

A total of 128 responded for the study. A clear female predilection was noted with 93 (72.7%) forming the study population. Students were in the mean age of 21.56 $\pm$ 6.74 years. Interns were the highest number of participants as seen in Table 1.

72 (48.6%) were aware of AI in dentistry, of which majority (83.2%) felt it was in research field. 85 (66.4%) agreed AI is important in dental education. Those who agreed felt AI improved diagnostic accuracy and enhanced treatment planning. Only 24% of the students felt confident for AI while 76.9% felt AI can improve the quality of dental education. The study results showed perceived benefits of incorporating AI into dental education was higher. This information can shed light on their expectations and potential advantages they associate with AI integration.

Thematic inference: Dental students raised some concerns regarding the ethical implications of integrating AI into dental education. They were particularly concerned about patient privacy, data security, and the responsible use of AI algorithms. Students emphasized the need for proper safeguards and adherence to ethical guidelines to protect patient information and ensure responsible AI implementation. Some also expressed concerns about the reliability and accuracy of AI algorithms.

Table 1: Demographic characteristics of study population

Variable					
Gender	*Male* 35 (27.3%)	*Female* 93 (72.7%)			
Age	21.56 ± 6.74 years				
Year	*1st* 27 (21.0%)	*2nd* 14 (10.9%)	*3rd* 13	*4th* 35	*5th* 39

Discussion:

Artificial intelligence (AI) is increasingly being utilized in various aspects of dentistry to improve patient care, diagnostics, treatment planning, and overall efficiency. Here are some key areas where AI is being applied in dentistry:(6 -9)

- Dental Imaging and Diagnosis: AI algorithms can analyze dental images such as X-rays, cone beam computed tomography (CBCT) scans, and intraoral images to assist in detecting abnormalities, identifying dental caries, periodontal diseases, and oral lesions. AI systems can aid dentists in making accurate diagnoses and treatment decisions.
- Treatment Planning: AI can assist in developing personalized treatment plans for patients. By analyzing patient data, including medical history, radiographic images, and clinical findings, AI algorithms can recommend optimal treatment options, prosthetic designs, and orthodontic treatment plans.
- Oral Cancer Detection: AI technology is used to analyze oral tissue images for early detection of oral cancer and potentially malignant disorders. These systems can aid in identifying suspicious lesions and assisting dentists in making timely referrals for further evaluation or biopsy.
- Virtual Reality and Augmented Reality: Dentists can utilize virtual reality (VR) and augmented reality (AR) technologies for patient education, treatment simulations, and preoperative planning. VR and AR platforms can help patients visualize the outcomes of dental procedures and improve their understanding of treatment processes.
- Robotics in Dentistry: Robotic systems, guided by AI algorithms, are being developed to assist dentists during surgical procedures, such as dental implant placement and complex surgeries. These systems can enhance precision, accuracy, and safety in dental procedures.
- Natural Language Processing: AI-powered chatbots and virtual assistants can be used in dental practices to automate appointment scheduling, answer frequently asked questions, and provide patient education. Natural language processing enables these systems to understand and respond to patient queries in real-time.
- Dental Records and Practice Management: AI can streamline dental record management, including patient data organization, data entry automation, and data extraction from clinical notes. AI-powered practice management software can enhance administrative tasks, appointment scheduling, and billing processes.
- Predictive Analytics and Risk Assessment: AI algorithms can analyze patient data, including oral health records, lifestyle factors, and genetic information, to predict the risk of dental diseases and suggest preventive measures. These systems can aid in personalized treatment planning and disease prevention strategies.

Our study showed that a good number of students (66.4%) were keen on AI adoption to dental education which is in concordance with Yuzbasioglu et al, which revealed that most students had a positive perception of AI integration, considering it a valuable tool for enhancing learning experiences and improving diagnostic accuracy. However, concerns related to algorithm reliability, ethical considerations, and the need for proper training are identified. (10)

Dental students are future practitioners who will be responsible for utilizing AI tools and technologies. Understanding dental students' perceptions of AI integration in dental education is crucial for designing and updating dental curricula. AI has the potential to improve diagnostic accuracy, treatment planning, and patient outcomes. (11) The study can provide insights into the specific areas where AI can be incorporated, ensuring that students receive relevant training and education to adapt to the evolving dental landscape. By identifying the perceived benefits, concerns, and readiness of dental students regarding AI integration, the study can inform the development of effective educational strategies. This can include targeted training programs, resources, and support to help students leverage AI technologies effectively in their future dental practice. (12)

However, incorporating AI into dental curriculum is not without limitations. Integrating AI into dental education raises ethical concerns regarding patient privacy, data security, and responsible use of AI algorithms. It is important to ensure that proper safeguards are in place to protect patient information and adhere to ethical guidelines. The integration of AI into dental education requires faculty and students to adapt to new technologies and learn how to effectively utilize AI tools. Adequate training and support should be provided to ensure that educators and students can maximize the benefits of AI in dental education.
Future recommendations for AI in dental education:

- By addressing concerns and reservations, educational institutions can proactively develop solutions and strategies to overcome these barriers, facilitating successful implementation and adoption of AI technologies.
- By studying the perception of dental students, the research can contribute to the growing body of evidence on the incorporation of AI in dental education, supporting evidence-based decision-making for educational reforms.
- The study can identify research gaps and areas for further exploration in the field of AI in dental education. It can guide future research endeavors to investigate the effectiveness, impact, and optimal utilization of AI technologies in dental practice, leading to continuous improvement and innovation.

The study highlights the importance of aligning dental curricula with emerging technologies and student expectations. It emphasizes the need to equip dental students with the necessary skills and knowledge to effectively utilize AI tools in their future practice. By integrating AI into dental education, educational institutions can better prepare students for the evolving dental landscape and foster a culture of continuous learning and technological advancement. As AI continues to advance and shape the field of dentistry, it is imperative to conduct further research, including longitudinal studies, to monitor the evolving perceptions and experiences of dental students regarding AI integration. This will ensure that dental education remains at the forefront of technological advancements, enabling students to harness the potential of AI to deliver quality oral healthcare in the future.

Conclusion:

In conclusion, the study on the perception of dental students in incorporating Artificial Intelligence (AI) into dental education provides valuable insights into the attitudes, beliefs, and expectations of future dental practitioners. The findings of this study shed light on the significance and potential impact of AI integration in dental education. The study reveals that 72 (48.6%) of dental students were aware of AI and its applications in dentistry, but their familiarity may vary. This highlights the need to ensure comprehensive exposure to AI concepts during dental education to bridge any knowledge gaps. However, the study also uncovers concerns and reservations held by dental students regarding AI integration.

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ANNEXURE 1:

Perception of dental students in incorporating Artificial Intelligence into dental education

(Participation is voluntary; All information will be kept confidential)

Section 1: Demographics

Gender: [Male / Female / Other]

Age: _____ years

Academic Year: [1st / 2nd / 3rd / 4th / Intern]

How familiar are you with Artificial Intelligence (AI)? [Not familiar at all / Somewhat familiar / Very familiar]

Section 2: Knowledge of AI in Dentistry

1. Have you heard about the use of AI in dentistry? [Yes / No]

If yes, please specify where you have encountered AI in dentistry (e.g., lectures, clinical practice, research):

Section 3: Attitudes towards Incorporating AI into Dental Education

2. Do you believe that AI can enhance dental education? [Strongly disagree / Disagree / Neutral / Agree / Strongly agree]

In your opinion, what are the potential benefits of incorporating AI into dental education? (Check all that apply)

a. Improved diagnostic accuracy
b. Enhanced treatment planning
c. Streamlined workflow in dental clinics
d. Access to a larger database of dental cases for learning purposes
e. Personalized learning experiences
f. Other (please specify): _____

3. Do you have any concerns or reservations about incorporating AI into dental education? [Yes / No]

If yes, please explain your concerns:

Section 4: Perceived Readiness for AI Integration

4. How confident do you feel in your ability to use AI technologies in dental practice? [Not confident at all / Somewhat confident / Very confident]
5. Do you believe that your dental education has adequately prepared you to understand and utilize AI in practice? [Yes / No / Not sure]

If no or not sure, please explain why:

Section 5: Preferred Methods of AI Integration in Dental Education

6. How would you prefer AI to be integrated into your dental education? (Check all that apply)

a. AI-driven virtual patient simulations
b. AI-assisted treatment planning and decision support
c. AI-based grading and evaluation of clinical work
d. AI-enabled personalized learning platforms
e. Other (please specify): _____

Section 6: Open-Ended Questions

6. What are your overall thoughts on the integration of AI into dental education?

In your opinion, what are the potential challenges or barriers to integrating AI into dental education?