

Original Research Article

Knowledge, attitude and perception toward robotics and artificial intelligence in dentistry among dentists and dental students of Assam: A cross-sectional study

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Abstract

Introduction: Artificial Intelligence (AI) and Robotics are the emerging technologies that are revolutionizing modern dentistry by improving diagnosis, treatment planning and clinical efficiency. Awareness and acceptance of these technologies by dental professionals is important for the successful integration of these technologies into clinical practice and education.

Objective: The objective of this online cross-sectional study was to evaluate the Knowledge, Attitude and Perception toward Artificial Intelligence and Robotics in dentistry among dentists and dental students in Assam.

Materials and Method: A cross-sectional online questionnaire study was conducted among 200 dentists and dental students of Assam. A structured self-administered questionnaire was distributed through Google Forms to assess the Knowledge, Attitude and Perception towards AI and Robotics in Dentistry. Descriptive statistics and chi-square test were done using SPSS version 27. $p \leq 0.05$ was considered statistically significant.

Results: This study revealed that 97% of participants had good Knowledge and positive Perception toward AI and Robotics in dentistry. All participants demonstrated a positive Attitude towards learning and adoption of these technologies. Most participants were aware of AI applications in radiographic interpretation (92%), prediction of implant placement (92%) and oral cancer detection (77%). Statistically significant association was found between knowledge and age and gender ($p \leq 0.05$) but not with qualification.

Conclusion: Dentists and dental students demonstrated favorable knowledge, positive attitude, and good perception regarding AI and Robotics in dentistry. Integration of AI-based learning into dental curriculum and clinical practice is recommended.

Keywords: Artificial intelligence, Robotics, Dentistry, Knowledge, Attitude, Perception.

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1. Introduction

Artificial Intelligence (AI) is a field of computer science that aims to build machines that can mimic human intelligence and carry out activities such as learning, reasoning, problem solving, and decision making.^{1,2} Robotics is the development of automated systems to assist clinicians in performing procedures with greater precision and efficiency.³ Recently, the application of AI and Robotics in healthcare and dentistry is increasing. AI technologies are becoming more and more popular in oral radiology, orthodontics, prosthodontics, implantology, oral pathology and forensic dentistry.⁴ AI-based software can help detect dental caries, periodontal diseases, oral lesions, and temporomandibular disorders with better diagnostic accuracy.⁵ Robotics has been

applied in implant placement, oral surgery and CAD/CAM procedures to reduce the operator fatigue and increase the accuracy of the treatment.⁶

Digital transformation in dentistry has created a need for dental professionals to understand the applications, advantages, and limitations of AI and Robotics.⁷ The successful implementation of these technologies largely depends on the awareness and acceptance of dentists and dental students. Although several international studies have evaluated the perception of AI among healthcare professionals, literature regarding awareness toward AI and Robotics in dentistry among Indian dental professionals remains limited.⁸

Hence, the present study was conducted to assess the Knowledge, Attitude, and Perception toward Robotics and Artificial Intelligence in dentistry among dentists and dental students of Assam. The hypothesis was that dentists and dental students possess favorable Knowledge and Perception regarding AI and Robotics in dentistry.

2. Materials and Methods

A cross-sectional online questionnaire study was conducted among dentists and dental students of Assam over a period of 2 months.

2.1. Study design

The present study was designed as a cross-sectional online survey.

2.2. Study duration

Two months i.e. August 2025 to September 2025.

2.3. Sample size and sampling method

Considering a 95% confidence level, a knowledge percentage of 68.3% (from previous studies) and a margin of error of 8%, the calculated sample size was 200. Considering a 10% non-response error rate, the Google forms were sent to a total of 220 participants. Participants were selected using a convenience sampling method. Individuals who met the inclusion criteria and were available during the study period were invited to participate.

2.4. Inclusion criteria

1. Dentists who had completed BDS or MDS degrees.
2. Dental students currently pursuing undergraduate or postgraduate dental education.
3. Individuals who were willing to participate in the study.
4. Participants who provided informed consent.

2.5. Exclusion criteria

1. Dental professionals who were not willing to participate in the study.
2. Participants who submitted incomplete questionnaires.

2.6. Ethical clearance

Ethical approval was obtained from the Institutional Ethics Committee before commencement of the study. Participants who were willing to participate and provided informed consent were included in the study.

2.7. Methodology

Data were collected using a validated structured self-administered questionnaire through Google Forms. The questionnaire included demographic information and questions on knowledge, attitude and perception towards AI and Robotics in dentistry. The questionnaire was composed of closed-ended questions with responses of "Yes", "No" and "Not sure".

Responses were analyzed to determine whether participants had positive Perception or poor Perception toward Artificial Intelligence. Scores were assigned to all the 24 questions as follows: 2 for 'yes', 1 for 'no', and 0 for 'not sure/don't know'. Higher scores indicated a positive understanding, lower scores indicated a negative understanding, and no scores indicated no view on Robotics and Artificial Intelligence in dentistry. The scoring criteria were as follows:

1. Knowledge - Good Knowledge: 4-10; Poor Knowledge: <4
2. Attitude - Positive Attitude: 11-20; Negative Attitude: <10
3. Perception - Positive Perception: 10-18; Negative Perception: <9

Based on responses, participants were categorized as having positive Attitude or negative Attitude. The initial study questionnaire was created in Microsoft Office Word and later converted into a Google Form for online data collection. Knowledge-related questions assessed awareness regarding applications of AI in radiographic interpretation, implantology, pathology, oral cancer detection, and treatment planning. Attitude-related questions assessed willingness to learn and work with AI technologies. Perception-related questions evaluated participants' views regarding benefits and future implementation of AI and Robotics in dentistry.

2.8. Statistical analysis

Data was entered in Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 27. Descriptive statistics such as frequency and percentages were computed. Association between demographic variables and knowledge levels was assessed using chi-square test and $p \leq 0.05$ was considered statistically significant.

3. Results

The study comprised of 200 dentists and dental students. Majority of the participants belonged to the age group of 20–29 years. Among them, 114 (57%) were males and 86 (43%) were females. Regarding qualification, 97 (48.5%) were MDS dentists, 93 (46.5%) were dental students, and 10 (5%) were BDS dentists.

Most participants were aware of AI applications in radiographic interpretation (92%), implant placement prediction (92%), and oral cancer detection (77%). About

79.5% of the participants reported that Robotics can assist in diagnosis and treatment planning.

All participants expressed willingness to learn AI in future dental practice. Nearly all participants believed that AI would improve diagnostic accuracy and clinical efficiency in dentistry. However, a small proportion of participants expressed concern regarding replacement of human skills and ethical issues associated with AI.

Overall, 194 (97%) of the participants demonstrated good Knowledge and positive Perception toward AI and Robotics in dentistry. All participants 200(100%) showed a positive Attitude toward learning and adopting these technologies.

Age and gender showed statistically significant association with knowledge regarding AI and Robotics ($p \leq 0.05$). Qualification showed no statistically significant association with knowledge ($p \leq 0.05$). The results of the present study are summarized in **Table 1–Table 7**.

Table 1: Knowledge regarding Robotics (R) and Artificial Intelligence (AI)

Questions related to knowledge	Not Sure /Don't know	No	Yes
Is Robot technology used to assist with patient diagnosis and the development of an integrated treatment plan?	24(12%)	17(8.5%)	159(79.5%)
Are Robots used in measurement of vital signs such as pulse, breathing, temperature, blood pressure and ECG?	18(9%)	37(18.5%)	145(72.5%)
Is Artificial Intelligence used in examinations and their interpretation, e.g. radiographs, CBCT, MRI, and differentiation between vital and pathological signs?	6(3%)	10(5%)	184(92%)
Is Artificial Intelligence used in the field of pathology for accurate reading of tissue samples and assists in the diagnosis?	6(3%)	30(15%)	164(82%)
Is Artificial Intelligence used in detection of oral cancer in its early stages, such as during health campaigns?	6(3%)	40(20%)	154(77%)

Table 2: Attitude regarding Robotics (R) and Artificial Intelligence (AI)

Questions related attitude	Not sure	No	Yes
Would you recommend treatment done with Robotics and Artificial Intelligence?	6(3%)	171(85.5%)	23(11.5%)
Would you prefer treatment with Robotics and Artificial Intelligence done on yourself, if needed?	6(3%)	178(89%)	16(8%)
Would you prefer to work in the Robot simulation lab for training in endodontics, crowns, bridges and fillings etc.?	0(0%)	36(18%)	164(82%)
Would you prefer to receive lectures or workshops from a Robot?	0(0%)	111(55.5%)	89(44.5%)
In your opinion, does receiving information from a teaching Robot increase self-confidence more than in a traditional classroom?	0(0%)	200(100%)	0(0%)
If you had the opportunity to work in a team that included a Robot as a participant, would you agree to join?	0(0%)	6(3%)	194(97%)

Table 2 Continued...

Would you like to learn about Robotics and Artificial Intelligence in the future?	0(0%)	0(0%)	200(100%)
Has the time come for students, doctors and individuals working in the university to accept Robotics and Artificial Intelligence techniques?	24(12%)	10(5%)	166(83%)
Do you feel that application of Robotics and Artificial Intelligence could enhance your clinical practice?	0(0%)	10(5%)	190(95%)
Do you think that there is a need to switch to a secure digital environment using Artificial Intelligence applications and create a health-care system with all the latest technologies?	30(15%)	10(5%)	160(80%)

Table 3: Perception regarding R and AI

Questions related to perception	Don't know	No	Yes
Is Robotics/ Artificial Intelligence beneficial in dentistry?	0(0%)	0(0%)	200(100%)
Can automated surgical Robots in oral and maxillofacial surgery work with the surgeon to perform a certain operation or may act as a surgeon's assistant?	18(9%)	30(15%)	152(76%)
In the field of orthodontics, can Artificial Intelligence provide a more accurate digital view of the mouth than the traditional method and predict the movement and the treatment of teeth, and work applications with wire rather than the laboratory?	16(8%)	20(10%)	164(82%)
In endodontic treatment, can working Robots reduce possible treatment errors and increase the quality of treatment?	6(3%)	20(10%)	174(87%)
Can Robotics/Artificial Intelligence contribute to predicting the correct placement of dental implants, providing 3D views before and during the process through an integrated simulation system?	16(8%)	0(0%)	184(92%)
Can Robotics/ Artificial Intelligence facilitate CAD/CAM and help in the process of teeth arrangement?	6(3%)	20(10%)	174(87%)
Can Artificial Intelligence replace dentists permanently?	13(6.5%)	187(93.5%)	0(0%)
Can Artificial Intelligence facilitate the preservation of patient information, data and accessibility quickly and accurately?	0(0%)	0(0%)	200(100%)
Can Robots contribute to increased career production, medical education and awareness in the community and individuals?	24(12%)	83(41.5%)	93(46.5%)

Table 4: Correlation of Knowledge with age (p<0.001 is highly statistically significant)

Age in years	Good Knowledge	Poor Knowledge	p value
20-29 years	92(47.4%)	1(16.7%)	<0.001
30-39 years	12(6.2%)	5(83.3%)	
40-49 years	45(23.2%)	0	
50-59 years	35(18%)	0	
≥60 years	10(5.2%)	0	
Total	194(100%)	6(100%)	

Table 5: Correlation of perception with age ($p < 0.005$ is statistically significant)

Age in years	Good Perception	Poor Perception	p value
20-29 years	92(47.4%)	1(16.7%)	<0.001
30-39 years	12(6.2%)	5(83.3%)	
40-49 years	45(23.2%)	0	
50-59 years	35(18%)	0	
≥60 years	10(5.2%)	0	
Total	194(100%)	6(100%)	

Table 6: Correlation of knowledge with gender ($p < 0.005$ is statistically significant)

Gender	Good Knowledge	Poor Knowledge	Total	p value
Male	114(100%)	0	114(100%)	0.004
Female	80(93%)	6(7%)	86(100%)	

Table 7: Correlation of Perception with gender ($p < 0.005$ is statistically significant)

Gender	Good Perception	Poor Perception	Total	p value
Male	114(100%)	0	114(100%)	0.004
Female	80(93%)	6(7%)	86(100%)	

4. Discussion

Artificial Intelligence and Robotics are rapidly emerging technologies with increasing applications in dentistry. Most of the participants (46.5%) in the present study belonged to the age group of 20–29 years, which indicates that the younger dental professionals and students formed the largest proportion of the study population. The younger ones were more exposed to digital tools, online learning platforms and technological innovations during their academic training. This finding was in accordance with the study done by Khanagar et al.³ and Schwendicke et al.⁴ Most participants were aware of AI applications in radiographic interpretation, 92% recognized its role in analyzing dental radiographs, CBCT and MRI images. This finding was similar to Schwendicke et al.⁴ Similarly, deep learning algorithms have been shown to significantly improve diagnostic accuracy in dental radiology.⁹

Most participants in the present study demonstrated good Knowledge regarding AI applications in dentistry. Similar findings were reported by Khanagar et al.³ who stated that AI has promising applications in diagnosis and treatment planning. Participants were particularly aware of AI applications in radiographic interpretation and implantology, which may be due to increasing use of digital imaging systems in dental practice.¹⁰

The present study also found that 82% of participants were aware of AI applications in pathology. This aligned with the findings of Khanagar et al.,¹¹ who demonstrated that AI models could analyse

histopathological images with high diagnostic accuracy in the detection and classification of oral cancer. This observation was also consistent with the broader scoping review by Arsiwala-Scheppach et al.,¹² who reported growing machine learning applications across multiple domains of dentistry. Compared to previous studies, the level of Knowledge observed in the present study was significantly higher. In contrast to the findings of our study, Kalaimani et al.⁶ reported moderate awareness levels (63.5%) of AI among dentists and dental students, while Mousavi Baigi et al.¹³ found that a majority of healthcare students had inadequate Knowledge of AI despite holding positive Attitudes toward it.

The attitude toward artificial intelligence among participants was overwhelmingly positive. The present study found that 100% of participants demonstrated a positive Attitude toward AI and Robotics. This finding was consistent with studies by Khanagar et al.³ and Asmatahasin et al.¹⁴

The Perception of participants toward AI and Robotics was highly positive. In the present study, all participants (100%) agreed that AI was beneficial in dentistry, indicating a strong acceptance of technological advancements which was consistent with the findings of the study conducted by Joda et al.⁵ Results were found to be significant when comparing Perception with age ($p < 0.05$). Similar findings were reported by studies conducted by Syed et al.¹⁶

In the present study, results were found to be insignificant when comparing perception with gender

($p>0.05$). Both male and female participants showed similar positive perceptions regarding the use of Artificial Intelligence and Robotics in dentistry. Similar results were observed in studies conducted by Baby et al.¹⁷ and Bisdas et al.¹⁸

In the present study, results were found to be insignificant when comparing perception with qualification ($p>0.05$). Dental students, BDS dentists, and MDS dentists showed comparable levels of positive perception toward Artificial Intelligence and Robotics. Similar observations were reported by Abouzeid et al.¹⁹

However, the study also revealed some hesitation regarding AI-based treatment. A majority of participants were not willing to recommend or undergo AI-based treatment themselves. This reflected concerns related to trust, reliability, and ethical considerations. Similar concerns were reported by Rokhshad et al.,²⁰ who emphasized the need to address ethical issues, data privacy, and patient safety before widespread implementation of AI in healthcare.

5. Limitations and Recommendations

This study had several limitations. Since the study was conducted through an online questionnaire and convenience sampling, the results cannot be generalized to all dentists and dental students. Response bias could also be there.

Multicentric studies on larger sample size are recommended to evaluate the implementation and acceptance of AI technologies in dental practice. Inclusion of AI based modules in curriculum at undergraduate and postgraduate level can be an add on to improve readiness for future digital dentistry.

6. Conclusion

Knowledge, Attitude and Perception of Dentists and Dental Students of Assam towards Artificial Intelligence and Robotics in Dentistry was found to be positive. Participants discussed how AI can improve diagnosis, treatment planning and clinical efficiency. Inclusion of AI based education, training programs and digital dentistry modules in dental curriculum is suggested for effective and ethical implementation of AI technologies in future dental practice.

Author Contributions

Enakshi Mitra: Conceptualization, methodology, investigation, data curation, formal analysis, writing—original draft, and project administration.

Navpreet Kaur: Study design, methodology, supervision, critical review, and editing of the manuscript.

Manish Bhalla: Conceptualization, supervision, validation, and critical revision of the manuscript.

Vivek Kumar Sharma: Data interpretation, statistical analysis, validation, and manuscript review.

Sonal Subhangi: Literature review, data collection, investigation, and manuscript editing.

Ramen Haloi: Supervision, validation, critical revision, and final approval of the manuscript.

All authors read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Ethical Approval

This anonymous questionnaire-based study involved voluntary participation. Electronic informed consent was obtained from all participants before completion of the survey. No personally identifiable information was collected, and participant confidentiality was maintained throughout the study.

Declaration of Patient Consent

Not applicable.

Financial Support and Sponsorship

Nil.

Conflicts of Interest

There are no conflicts of interest.

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