

KNOWLEDGE AND COMPREHENSION REGARDING ARTIFICIAL INTELLIGENCE USED IN DENTISTRY FROM DENTAL SCHOOL STUDENTS: A CROSS-SECTIONAL SURVEY

Dentistry

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ABSTRACT

Background: Artificial Intelligence is the most recent specialties of scientific and technological innovation is referred to as "The Stethoscope of the 21st Century". The sheer scope of modern digital technology in the workflow of the dentistry has a favourable impact on dental care, quality treatment, and patient happiness. **Objectives:** To assess Knowledge and Attitude regarding the use of Artificial Intelligence among Dental students. **Methods:** This cross-sectional survey involves undergraduate students (I to IV year), Interns, Postgraduate Students and Junior Residents of Adesh University. The mean age of students was 18-25 years. A 10-item Knowledge based questionnaire and 13-item Attitude based questionnaire was used for data collection. IBM-SPSS version 22 was used for statistical analysis. The e-questionnaire was sent to 360 potential study participants out of which 330 were completed and analysed. **Results:** The overall response rate was 240 (75 %) females and 80 (25 %) males. The majority of respondents (89.1%) reported being familiar with the concept of Artificial Intelligence. Social media (70.9%) was the most commonly cited source of information about Artificial Intelligence, followed by online articles (8.1%), and academic lectures (15.3%). According to the majority of respondents, Public health centres are the first to commercialize Artificial Intelligence. **Conclusions:** The study provides a baseline understanding of dental students' knowledge and attitudes towards Artificial Intelligence.

KEYWORDS

Artificial Intelligence, Dental Education, Awareness

INTRODUCTION

The human intellect is the most captivating, developed, capable of any creation on the planet, making it preeminent.^{1,5} Artificial Intelligence (AI), which is most recent specialties of scientific and technological innovation and is referred "The Stethoscope of the 21st Century," implies that it is significant for the medical and dentistry professions.⁶ Artificial Intelligence is the property of computers or other technologies to learn intelligence in order to do jobs that require human cognition.²

A few examples of how Artificial Intelligence has impacted practically every element of our everyday lives, including virtual aids like Apple Siri and Alexa, facial recognition technology, healthcare systems, automatic driving and parking cars, robotics, smart replies in emails, smart maps, and other aspects of our daily life.^{1,3} India is a nation that is on the cutting edge of technology but has not yet reached its full potential.² The concepts underlying Artificial Intelligence and its potential impacts our private and professional lives and is still unknown to many individuals, including researchers and members of the medical profession.^{1,2}

Dentistry is an industry that is always developing and becoming more inventive.⁴ The sheer scope of modern digital technology in the workflow of the dentist office has a favourable impact on dental care, quality treatment, and patient happiness.⁴ There are many fascinating uses of Artificial Intelligence in healthcare, ranging from patient appointment booking to early diagnosis of health issues and usage as an efficient tool for treatment planning, to monitoring patient adherence to treatments.⁵ CBCT, three-dimensional intraoral or facial scanners, and integrated software such as prosthetic CAD/CAM software and implant programming in dentistry, have all been introduced to be ground-breaking pieces of digital assets in the field of dentistry.⁷ The advent of these new procedures, together with significant advancements in dental materials, is revolutionizing the whole profession of dentistry.⁴

The world is constantly changing, so neither "today" nor "yesterday" are the same, and neither is "tomorrow," which still has a lot of room for growth.⁵ The possibilities of Artificial Intelligence software in dental care are quite captivating and can be extremely beneficial for dental professionals who are just beginning their careers. Despite the advantages of using digital dental technologies, a number of factors

affect how effectively they are used in dentistry. One of the most significant reasons limiting effectiveness and utilisation of Artificial Intelligence in dentistry is lack of expertise and skills. The current study aims to evaluate the comprehension and cognizance that dental school students' exhibit regarding Artificial Intelligence at a North Indian Health University.

OBJECTIVES

For assessing dental students' knowledge of Artificial Intelligence and to determine how students anticipate about using these applications.

MATERIALS & METHOD SURVEY DESIGN

This cross-sectional survey was conducted among the students of Adesh Institute of Dental Sciences and Research, Adesh University, Bathinda, Punjab, India. Study duration was of 2 months i.e. from September 2023 to October, 2023. The Institutional Research Committee of Adesh University granted ethical approval for the study.

Inclusion Criteria

1. Participants who gave informed consent.
2. BDS I, II, III, IV, Interns, Postgraduates Students & Junior Residents.
3. Participants who had smartphones.

Sampling Technique

Convenience technique was employed due to the accessibility and ease of gathering data from the study population.

Sample Size Estimation

The prevalence used for estimating the sample size for this research is the same ($p=64\%$) as in the earlier study done by Shobha Fernandes et al. in Gujarat. (Knowledge, Attitude, and Practice of Dental Students Towards Artificial Intelligence (AI): A Questionnaire Based Survey).

The sample size was calculated using $N = z^2 p(1-p)/d^2$

The minimum sample size obtained, $N = 354$ (353.8)

Study Instrument

The online Google form survey questionnaire consisted of 3 sections.

Section 1- Socio-demographic details (Gender and Academic Year of

students).

Section 2- Knowledge based Questionnaire

Section 3- Attitude based Questionnaire

Data Collection

Data collection was done using the online Google form. The e-questionnaire was shared with the study participants using social media platforms such as WhatsApp. Prior to the questionnaire, the Google form contained a concise summary of the study along with an informed consent form.

Data Handling & Privacy

All data will be securely stored and only be accessed by the study team. The confidentiality of participant information will be carefully preserved.

Data/ Statistical Analysis

Data from completed surveys was compiled in an Excel file and analyzed. The statistical analysis was done using SPSS version 22 and to evaluate the correlation, chi-square test was implemented. A p-value <0.05 is considered of statistical significance.

RESULTS

Participants

The e-questionnaire was sent to 360 potential study participants. 345 questionnaires were returned. 330 questionnaires were completed and analyzed. The mean age of participants was above 18 years. Hence, the overall response rate was 240 (75 %) females and 80 (25 %) males. Interns, Postgraduate Students, Junior Residents, and BDS I, II, III, and IV were the target population for this research.

Table 1: Demographic Profile Of Study Population

		Frequency	Percent
Gender	Males	80	25.0%
	Females	240	75.0%
Academic year	BDS 1 st year	89	27.8%
	BDS 2 nd year	46	14.4%
	BDS 3 rd year	30	9.4%
	BDS 4 th year	68	21.3%
	Interns	74	23.1%
	Junior Resident	7	2.2%
	Post-graduates	6	1.9%

Table 1 shows the Demographic profile (Gender and Academic year) of the research population. It showed the majority of the study respondents were females (75%), BDS 1st year students (27.8%), followed by Interns.

Academic year wise distribution

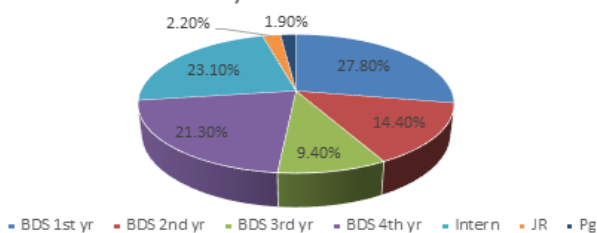


Table 2: Knowledge Based Questionnaire

QUESTION	RESPONSE	FREQUENCY	PERCENT
1. Familiarity with the concept of AI	No	12	3.8%
	Maybe	23	7.2%
	Yes	285	89.1%
2. Source of Information about AI application	Family, friends	18	5.6%
	Lectures	49	15.3%
	Newspaper, magazines	26	8.1%
	Social media	227	70.9%
3. Which health care sector do you think will be the first to commercialize Artificial Intelligence?	Primary care in private clinic	32	10.0%
	Public health centres	120	37.5%
	Speciality clinics	84	26.3%
	University clinics	84	26.3%

4. What benefits of using Artificial Intelligence do you think there are?	Speed up the process	31	9.7%
	Deliver vast amounts of clinically relevant data	16	5.0%
	No emotional exhaustion or physical limitation	10	3.1%
	All of the above	263	82.2%

The majority of respondents (89.1%) reported being familiar with the concept of Artificial Intelligence. Social media (70.9%) was the most commonly cited source of information about Artificial Intelligence, followed by online articles (8.1%), and academic lectures (15.3%). According to the majority of respondents, Public health centres will be the first to commercialize Artificial Intelligence. According to respondents, all the mentioned benefits are true. (Table 2)

Table 3: Knowledge Based Questionnaire

Questions		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
5. AI has useful applications in medical field	n	2	7	48	155	108
	%	0.6%	2.2%	15.0%	48.4%	33.8%
6. AI can be incorporated into dentistry	n	3	19	68	147	83
	%	0.9%	5.9%	21.3%	45.9%	25.9%
7. AI will be most effective in diagnosis & treatment planning	n	1	15	80	159	65
	%	0.3%	4.7%	25.0%	49.7%	20.3%
8. AI can be used in diagnosis of soft tissue lesions of oral cavity	n	1	16	87	165	51
	%	0.3%	5.0%	27.2%	51.6%	15.9%
9. AI can be applied in the radiographic diagnosis of jaw pathologies	n	1	6	55	191	67
	%	0.3%	1.9%	17.2%	59.7%	20.9%
10. AI can be applicable in forensic dentistry	n	1	5	46	195	73
	%	0.3%	1.6%	14.4%	60.9%	22.8%

For Knowledge items (5-10), majority of respondents were found to be "Agree". (Table 3)

Table 4: Attitude Based Questionnaire

Questions		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1. AI's capability for diagnosis can surpass a human doctor's actual clinical expertise	n	7	61	88	131	33
	%	2.2%	19.1%	27.5%	40.9%	10.3%
2. AI can be a better tool when there is a conflict between your medical judgement & AI application	n	03	33	102	141	41
	%	.9%	10.3%	31.9%	44.1%	12.8%
3. AI will have an impact in the field of dentistry in India	n	01	13	65	182	59
	%	.3%	4.1%	20.3%	56.9%	18.4%
4. AI will eventually replace physicians or dentists	n	43	93	76	86	22
	%	13.4%	29.1%	23.8%	26.9%	6.9%
5. When compared to traditional dentistry, AI produce more precise results	n	04	28	116	139	33
	%	1.3%	8.8%	36.3%	43.4%	10.3%
6. AI will eventually transform the workplace	n	01	17	79	190	33
	%	0.3%	5.3%	24.7%	59.4%	10.3%
7. AI simulates dental patients using humanoid robots	n	4	22	142	121	31
	%	1.3%	6.9%	44.4%	37.8%	9.7%
8. Quality of patient care will suffer as a result of employing AI	n	2	38	104	144	32
	%	0.6%	11.9%	32.5%	45.0%	10.0%

9. AI makes it easier to evaluate radiographs' minute details, which are sometimes overlooked by practitioners	n	0	7	81	180	52
	%	0%	2.2%	25.3%	56.3%	16.3%
10. You might use AI to plan dental treatments and diagnose diseases in future	n	3	4	75	194	44
	%	0.9%	1.3%	23.4%	60.6%	13.8%
11. AI may be used as a prognosis tool to predict the development of a disease and its probability of recovery.	n	3	6	84	183	44
	%	0.9%	1.9%	26.3%	57.2%	13.8%
12. AI can be used to evaluate the efficacy of treatments as a quality control tool	n	3	5	76	192	44
	%	0.9%	1.6%	23.8%	60.0%	13.8%
13. AI should be addressed in both undergraduate and postgraduate dental programmes.	n	0	7	55	191	67
	%	.0%	2.2%	17.2%	59.7%	20.9%

For all the Attitude questions (1-13) except Q4 & Q7, majority of respondents were found to be "Agree". (Table 4)

DISCUSSION

Artificial Intelligence has led to numerous developments in Dentistry in the past few decades that everyone is looking forward to the future.⁴ Assessing the scope of dental candidates' Knowledge as well as their Attitude towards Artificial Intelligence is becoming more and more important, owing to the persistent technological developments that have an impact on the general public. This can be useful for modifying educational resources appropriately.⁴ Artificial Intelligence is under scrutiny for a number of reasons, including the ability to distinguish between normal and atypical structures, diagnosis, and predict outcomes of treatment.¹ This study sought to analyze students' understanding and perspectives on the implementation of the use of AI in dental care. The results provided some insight into future dental professionals' awareness as well as perspectives of Artificial Intelligence.

The significant finding was the majority of responders were acutely aware with the notion of Artificial Intelligence, with social media serving as the primary source of knowledge. Comparative with studies in different regions of India, such as the Telangana study performed by Asmatahasan M et al (2021), indicated 89.63% of students were aware of the phrase Artificial Intelligence, which was higher.⁵ This highlights the influence of popular media on shaping initial perceptions of emerging technologies. However, it also suggests that formal dental education may need to play a more active role in providing accurate and comprehensive information about Artificial Intelligence. Relying on social media for information may lead to misinformation or unrealistic expectations about Artificial Intelligence's capabilities and limitations.

In terms of Knowledge, there was overall agreement with statements about Artificial Intelligence's potential benefits and applications in Dentistry. This positive baseline knowledge is encouraging, as it indicates a foundation to pursue further training and study. However, the specific areas where knowledge was lacking (questions 5-10) could be targeted in future curricular initiatives. In Chennai, around 59% of research participants had awareness of Artificial Intelligence.⁹

The Attitude towards Artificial Intelligence was also predominantly positive, with agreement that it will be beneficial in various aspects of dental practice. The exceptions (questions 4 and 7) may indicate some initial reservations or skepticism about the potential for Artificial Intelligence to replace human dentists or create over-dependence on technology. According to this study, 86% of students agreed that Artificial Intelligence could potentially replace dentists, which differs from the findings of Pinto Dos Santos et al., who discovered that the public is roughly two times more inclined to concern (72%) than excite (33%) about the future in which computers and robots do human jobs.⁸ These concerns will need to be addressed through exposure to real-world examples and demonstrations of Artificial Intelligence as a tool that enhances, not replace, the abilities and judgment of dental practitioners.

The finding that public health centres were perceived as the most likely to first implement Artificial Intelligence is interesting. This may reflect a belief that publicly-funded services are more likely to adopt new technologies due to resource availability or a mandate to provide efficient care. Further research could explore this perception in more detail.

Overall, this study provides a baseline understanding of Dental students' Knowledge and Attitudes regarding Artificial Intelligence. As Artificial Intelligence becomes increasingly integrated into Dental education and practice, ongoing assessment and education will be imperative in ensuring that future professionals can maximize the benefits and navigate the challenges of these technologies. The findings emphasize the importance of comprehensive teaching activities including both technical and attitudinal elements of AI adoption in dental medicine.

CONCLUSION

The outcome of the study highlights that participants have a positive perspective toward Artificial Intelligence in dentistry and are motivated to learn about innovations in the area. This excitement may foster a pleasant learning environment, enable novel teaching techniques, and welcome future dental educators. However, the dentistry curriculum should emphasize critical thinking, self-learning, and research comprehension.

LIMITATIONS

This study is confined to students from one dental institution in North India. Selection bias may be introduced by convenience sampling. Future studies should aim for a more diverse sample of dental students and potentially include comparison groups of practicing dentists or other stakeholders. As Artificial Intelligence continues to evolve, longitudinal research will be needed to assess how knowledge and attitude changes over time and with increasing exposure to Artificial Intelligence in Dental education and practice.

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Conflict Of Interest

No potential conflicts of interest.

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