

ORIGINAL RESEARCH

Awareness about Artificial Intelligence among Dental Practitioners and Dental Students – A Cross-sectional online survey

Sheela Kumari K^a, Murugesan K^b, Naveen Gokul R^c, Priya M V^c

ABSTRACT

Background: Artificial intelligence (AI) had been used in various fields because of its time effectiveness and less laborious. AI based tools can be highly beneficial in healthcare sectors to predict treatment and prognosis. In dentistry AI has been trending, specifically in diagnostic imaging and early detection of diseases, benefitting both dental graduates and practitioners.

Aim: This study was done to assess the awareness of Artificial intelligence as an effective tool among dental trainees and dental practitioners.

Materials and methods: A cross sectional questionnaire survey was conducted through online, via Google forms. The created questionnaire link was distributed among dental interns and dentists in Chennai and Thiruvallur districts, during the months of March to July 2023. It consisted of 20 questionnaires regarding participant's awareness and knowledge towards AI, its current and future usages in the field of dentistry. The results were then obtained, analysed statistically by using SPSS Statistics software version 20.0 (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.). Chi square test, ANOVA test were performed and 'p' value <0.05 was considered significant.

Results: More than 60% of the participants showed confidence about their familiarity towards AI in dentistry (p<0.01197). Among those, 60.5% answered that they are well aware of ChatGPT and 28% of them to Microsoft Bing (p<0.04395). 53% answered that machine learning is an important form of AI (p<0.00216). Over the advantages of AI, 43% believed AI can improve diagnostics, access to disease screening, cost effectiveness, reduced treatment time (p<0.0001) and 53% agreed that AI can be useful in day-to-day dental practices (p<0.0001).

Conclusion: The present study showed that awareness of AI among the dental fraternity was satisfactory. The field of AI is said to be emerging rapidly and various other new applications in AI are being utilised. AI can act as a valuable tool in supporting clinicians delivering effective dental care and supplementing education for dental trainees. To enhance the future of AI in dentistry, the present curriculum needs to be approachable enough and various hands-on-training are essential.

Key words: artificial intelligence, chatbots, dental caries, radiographic diagnosis, teledentistry.

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INTRODUCTION

Artificial Intelligence (AI) was first proposed by John McCarthy in 1956 in the field of computer science and technology. According to him, artificial intelligence (AI) is defined as "The science and engineering of making intelligent machines, especially intelligent computer programs; it is related to the task of using computers to understand human intelligence, but AI does not have to be confined to the methods that are biologically observable."¹ In other words, Artificial intelligence is the process of obtaining intelligence through computers or electronic machines, capable of

performing laborious tasks that generally requires human intelligence.² AI is being used in various applications of healthcare industry including decision making, improved business processes, higher quality optimization, monitoring and delivering individualized treatment regimens and many more.³ As a technologically progressing country, India is on its way to reach full potential in harnessing AI technology where 1.3 billion Indians have an internet connection among which 70% are between age 18-60 years.⁴ Introduction of virtual assistants, AI chatbots, face recognition, self-driving cars and other areas of our day to day activities

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shows how much AI has penetrated into our lives. Many people, including medical professionals and researchers are still not sound about artificial intelligence (AI), as well as its potential effects on personal and professional lives. In dentistry, the use of AI programs in clinical settings has grown in popularity, particularly in diagnostic imaging, which benefits recent dental graduates and practitioners. Among other tasks, AI systems enable detection of inferior alveolar nerve before surgeries, sites for implants, assessing facial growth, tracing of cephalometric landmarks, early detection of oral tumors, workflow optimization in clinics, appointment scheduling and billing and detection of caries.^{5,6} In future, artificial intelligence reduces the burden of educator and cost of education⁷. Hence the present questionnaire based study was conducted among the dental students and dental practitioners to assess their awareness towards artificial intelligence.

MATERIALS AND METHOD

A cross-sectional questionnaire survey was conducted through online, via Google forms and the created questionnaire link was distributed among dental students and dentists in Chennai and Thiruvallur districts (through WhatsApp groups/emails) during the months of March to July 2023. It consisted of questionnaires regarding participant's awareness and knowledge towards AI, its current and future usages of AI in dentistry. About 20 questionnaires were included in survey form on the based on the studies conducted by Sur et al and Keser et al.^{4,5} The content of the survey was verified by the researchers (n=3). Participants were given information about the survey and a brief description regarding AI was given in the preface of the questionnaire. About 200 participants answered the questionnaire, out of which 107 were dental trainees and 93 were dental practitioners. INCLUSION CRITERIA

- Participants who are dental practitioners and currently working in dental clinics/hospitals
- Students pursuing dental education specifically internship as dental trainees
- Postgraduate students who are currently practicing dentistry

EXCLUSION CRITERIA

- Individuals who have not yet commenced their formal dental education programs and not a active working dental professional.
- Individuals enrolled in dental hygiene programs, dental assistant courses, or other non-dental professional programs.
- Students who are on academic suspension, or any other inactive status.
- Dental trainees and practitioners who are not within the age groups of 18-60 years.

RESULTS

The collected data were compiled in a master Excel sheet 2007. Statistical analysis were carried out by using the SPSS Statistics software version 20.0 (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.). Chi square test, ANOVA test were performed and 'p' value <0.05 was considered significant. A total of 200 responses were received from dental trainees and dental practitioners. The study group falls between the ages of 18-60 years.

Among the study 68.5% (n=137) were female participants and 31.5% (n=63) were male participants. From Table 1, various responses with the respect to questionnaire is tabulated. The participants of about 53.5% were dental trainees (n=107) and 46.5% (n=93) were dental practitioners. From Figure 1, about 60% of the participants showed confidence about their familiarity towards AI in dentistry (p<0.01197). Among those, 60.5% answered that they are well aware of ChatGPT and 28% of them to Microsoft Bing (p<0.04395). More than 54% participants addressed AI can overcome iatrogenic errors. Majority of participants (85.5%) think that AI can help in treatment planning. From Figure 2, 48% of participants were in a scenario whether to accept AI in supporting as well overtaking clinician in treating patients.

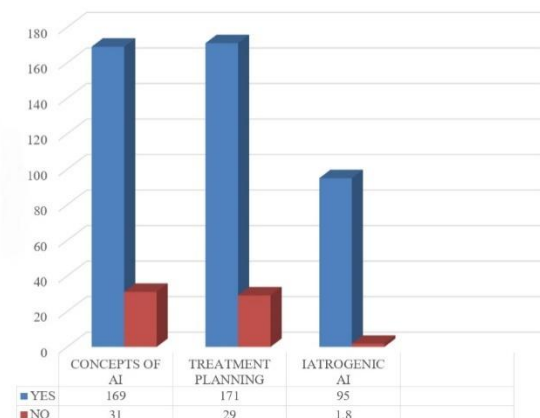


Figure 1: Results of two-point scaled questionnaire.

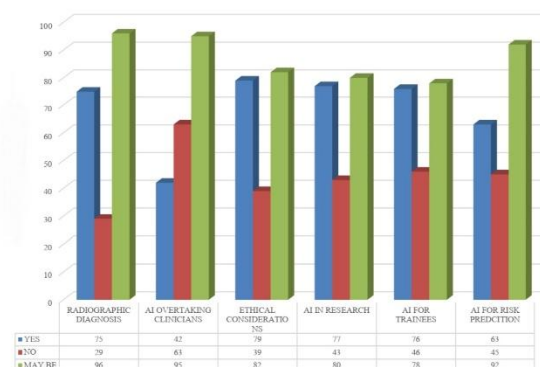


Figure 2: Results of three-point scaled questionnaire.

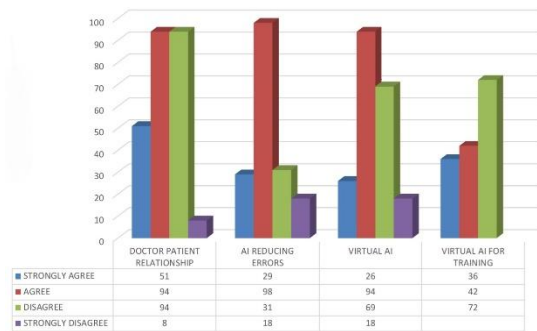


Figure 3: Results of four-point scaled questionnaire.

Dental trainees and practitioners of 41% felt that there are ethical issues in incorporating AI in dentistry, whereas 47% agreed that AI can also act as virtual assistants.

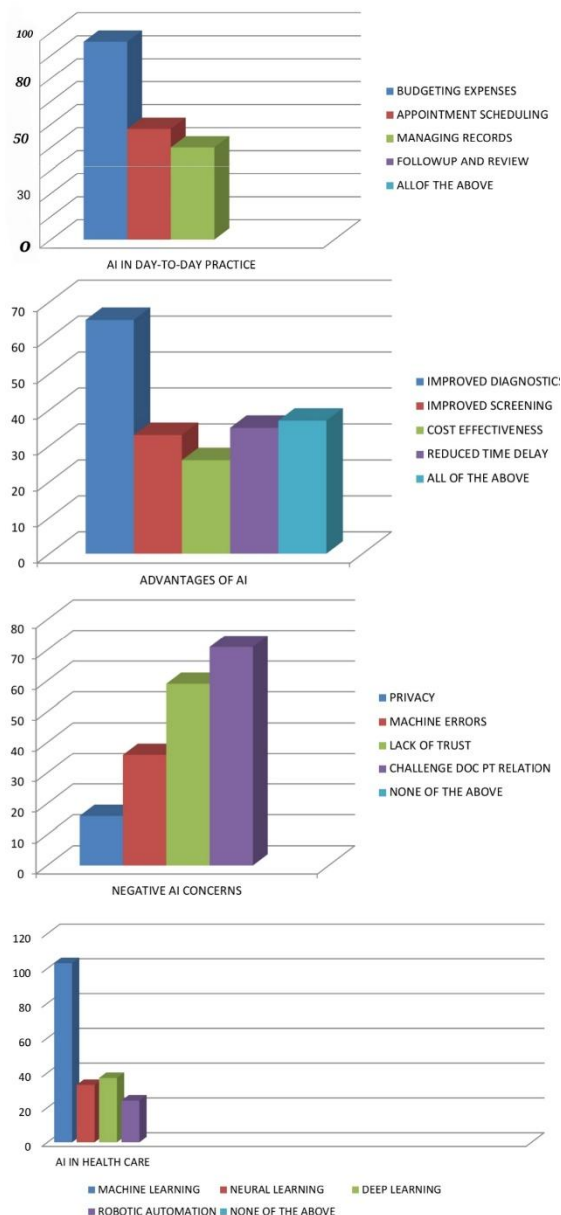


Figure 4: Results of other multiple choiced questionnaire.

Among them, a total of 40% responders believed

Questions (n = 20)	Options	Dental Trainees (n = 107)	Dental Practitioners (n = 93)	'p' value P<0.05
Are you familiar with the usage and new concepts of AI in dentistry?	Yes	84	85	0.01197
	No	23	8	
Which are the commonly used AI chat bots?	Microsoft Bing	28	26	0.04395
	Perplexity	5	11	
	Yachat	3	8	
	ChatGPT	71	48	
Do you think AI can be helpful for treatment planning in dentistry?	Yes	90	81	0.54989
	No	17	12	
Which of the following forms of AI in health care are you aware of?	Machine learning	63	40	0.00216
	Neural language processing	20	13	
	Deep learning	17	20	
	Robotic process Automation	4	19	
	None of the above	3	1	
Are you aware of Iatrogenic Artificial Intelligence (Negative consequences of AI) ?	Yes	53	42	0.53692
	No	54	51	
What are the common Iatrogenic Artificial Intelligence are you aware of?	Misdiagnosis and bias	25	22	0.124239
	Overreliance on AI	9	21	
	Lack of user understandin	17	15	
	Data privacy and security	31	25	
Do you think AI can assist clinician in radiographic diagnosis of dental caries and other oral lesions?	Yes	42	33	0.58207
	No	13	16	
	May be	52	44	
Do you think can AI overtake clinicians in treatment of patients?	Yes	18	24	0.15489
	No	39	24	
	May be	50	45	
What are your negative concerns over AI in dentistry	Privacy and security	11	5	0.2073
	Liability and machine errors	19	17	
	Lack of trust in the diagnostic capability	27	32	
	Challenge for the doctor-patient relationship	43	28	
	None of the above	7	11	
Do you think AI can affect doctor-patient relationship?	Strongly agree	37	14	0.14499
	Agree	54	40	
	Disagree	13	10	
	Strongly disagree	3	5	
What do you think are the advantages of AI in dentistry?	Improved diagnostics	55	10	0.00001
	Improved access to disease screening	22	11	
	Cost efficient oral care	18	8	
	Reduced time in dental treatments	9	26	
	All of the above	3	34	
To what extent do you agree with the following statement: "AI will reduce clinician induced errors in dentistry"	Strongly agree	12	17	0.12575
	Agree	62	36	
	Disagree	21	10	
	Strongly disagree	12	6	

Table 1: Responses to the questionnaire and their correlations by independent sample 't' and ANOVA tests.

that AI may be useful in research and development of newer medicines in dentistry. 39% participants answered AI can be useful in providing dental education at colleges. From Figure 3, about 52.5% were ill informed about iatrogenic AI, its form and 52.5% agreed that misdiagnosis and bias is a drawback of iatrogenic AI. Among them 34% said they are partially familiar to Virtual AI simulation (p<0.0001). While addressing dental education to the patients, 39.5% of participants argued AI can be used for such purposes.

From Figure 4, over the advantages of AI, 43% believed AI can improve diagnostics, access to disease screening, cost effectiveness, reduced treatment time ($p < 0.0001$) and 53% agreed that AI can be useful in day-to-day dental practices ($p < 0.0001$). Out of 200 participants, 46% of participants answered AI can predict risks and prognosis of treatments. 53% answered that machine learning is an important form of AI ($p < 0.00216$). According to 40% of participants, liability, machine errors and challenging patient doctor relationship are the main negative concerns of AI.

Do you think there can be any ethical considerations or challenges regarding the usage of Artificial Intelligence in dentistry?	Yes	42	37	0.257198
	No	20	19	
	May be	45	37	
Do you agree to the following statement: "Can AI provide post-treatment care of patients by acting as virtual dental assistants?"	Strongly agree	9	17	0.13165
	Agree	54	40	
	Disagree	36	33	
	Strongly disagree	12	6	
Can AI be used to improve clinical research such as development of newer drugs in dentistry?	Yes	44	33	0.22361
	No	18	25	
	May be	45	35	
In what ways can AI be useful in improving the access to dental care?	Tele-dentistry services	9	12	0.39237
	Personalised dental care	21	15	
	AI powered dental educational resources and dental chat bots	50	72	
	None of the above	5	16	
According to you, can AI be useful in teaching dental trainees at dental colleges?	Yes	39	37	0.25719
	No	21	25	
	May be	47	31	
How AI powered technology can assist administrative tasks in day-to-day dental practices?	Budgeting clinic expenditures	37	14	0.00001
	Appointment scheduling and Billing	43	13	
	Managing patient records	14	19	
	Successive follow-up and review	8	5	
	All of the above	5	42	
Do you think can AI predict potential risks and prognosis of complex dental treatments?	Yes	33	30	0.069362
	No	18	27	
	May be	56	36	
Are you familiar with the concepts of AI Virtual Dental Simulation?	Completely familiar	20	16	0.0001
	Moderately familiar	17	25	
	Somewhat familiar	50	22	
	Not familiar at all	12	30	

Table 1: contd. Responses to the questionnaire and their correlations by independent sample 't' and ANOVA tests

DISCUSSION

For the past three decades, there had been an evolving tendency towards the applications and usage of Artificial Intelligence. Various successful products and services have been introduced to the general public, medical professionals, and private organizations. This online Google questionnaire-based study evaluated the awareness among 200 dental trainees and dental practitioners in Tamil Nadu, India, regarding the future of AI. There was a requisite knowledge of artificial intelligence among the dental trainees compared to dental practitioners. According to Choudhary et al.⁸, more than 70% of the participants thought that AI can be used for

radiographic diagnosis of dental caries, whereas in our study more than 60% of dental trainees and dental practitioners believed that AI can be used for the same purpose. He also reported that 39.7% of responders assumed that AI will lead to major advances in dentistry, which was similar to our study where 40% of participants agreed AI can also bring advancements in dentistry. Literature showed studies conducted in various parts of India, where 60% in Jammu and Kashmir, 59% in Chennai, and 89.63% in Telangana revealed awareness about AI among students,^{8,9,10} which was comparable to our current study where 60% of responders knew the usage of AI in dentistry. Various international studies conducted in Turkey and Saudi Arabia, also reported that about 48.4% and 49.9% respectively in each country had requisite knowledge about AI.^{11,12} Dentists who regularly attend conferences and take part in online discussion boards could be more aware of the possible uses of AI.¹³ The same study also stated that the intention of AI was never to replace the clinician. A study by Davenport¹⁴ on comparing the methods of patient diagnosis, he showed that 59% of practitioners felt use of AI is advantageous than conventional diagnosis, whereas in our study 43% of responders accepted that AI is advantageous. This could be true, since dental training robots are widely used in countries like Japan, Mexico and USA for training undergraduates.^{15,16} In a study conducted by Tai MC,¹⁷ about 71% of western population fear that AI has negative concerns, whereas in comparison to our current study only 40% of participants felt that liability, machine errors, and complicated patient-doctor relationship were the main negative concerns. According to Zhai et al. in his study,¹⁸ ChatGPT was a well-known chatbot among dental trainees and dental practitioners in improving healthcare, which was in accordance with our study where 66% of participants reported the same. Khanagar et al.¹⁹ reported that AI models had excellent performance, used for prediction, early detection and diagnosis of dental caries. Sajjad et al.²⁰ in his study showed that (100%) of the participants agreed that AI should be a part of dental treatment, but in the present study, only 43% of subjects agreed on the use of AI in treatment planning. In day-to-day dental practices, a study by Sajjad and his colleagues²⁰ concluded that 44.43% believed that AI can support dentists whereas in the present study, 53% participants agreed that AI can be helpful in assisting dentists. A study by Aboalshamat et al.²¹ suggested that responders of 49.1% strongly agreed that AI could replace dentists, which was similar to our study where 48% of participants were in a scenario whether to accept AI in supporting as well overtaking clinician in treating patients. McCradden et al.²² in his study found that about 39% of the participants felt their data had some ethical considerations regarding application of AI, which is in correlation with our

present study where 41% of participants agreed the same. According to Murdoch TB et al²³ when comparing various forms of AI, machine learning was the most striking aspect in health care, which was similar in our study where 53% of participants answered that machine learning is an important form in AI. Topol. et al²⁴ reported the major iatrogenic aspect of AI was misdiagnosis and had potential risks in treating patients, which was accordance to our study where 52.5% of subjects accepted the same. Ana Suarez et al²⁵ in their study showed that AI cannot replace the understanding, decision-making and inherent responsibility in healthcare and hence it cannot act as virtual dental assistant. This was relevant in our study, where 47% disagreed the same. Mahmood et al²⁶ in their study showed that 79% of participants accepted that AI could be used in dental colleges to teach trainees which was in contrast to our study, where only 39% of responders accepted the usage of AI in dental colleges. Keser and Pekiner et al.⁵ in their study on comparing medical clinicians and trainees, reported that 41.1% of the participants were not sure if AI would make a better diagnosis than a human doctor, whereas in our study 54% of participants agreed that AI will reduce errors and provide better diagnosis. Studies conducted at various countries and institutions reveals differences in the perception of AI among trainees and clinicians. The main limitation of this study was the restriction in number of participants, who were mainly dental trainees (CRI) and practitioners in Chennai and Thiruvallur districts of Tamil Nadu, India. Therefore, further studies needed to be carried out at a larger scale to increase the statistical accuracy.

CONCLUSION

The present study revealed that the awareness of AI among the medical professionals dental fraternity was said to be satisfactory when compared students. Dentists had varying opinions regarding the usage of AI. Therefore, to enhance awareness about AI, it needs to be disseminated through proper channels such as state and national dental associations, educational and research institutions, technological companies by promoting their AI-related products and educational resources. The field of AI is evolving rapidly, with new applications and tools being developed regularly. Dentists along with other medical professionals, could collaborate with AI for performing tasks such as diagnosis, workflow management, patient records, billing and complex surgical procedures.

CONFLICT OF INTEREST:

There was no conflict of interest

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