

Attitude and Perception of Dental Students Towards Artificial Intelligence.

ABSTRACT

Introduction: Artificial intelligence has been advancing in various medical fields including dentistry. This research was conducted to test the knowledge, attitude and practices regarding artificial intelligence among undergraduate and postgraduate dental students.

Material and Methods: A cross-sectional, questionnaire-based study was conducted among undergraduate and postgraduate students in a dental institute of Sri Ganganagar, Rajasthan. A 15 item pre-tested and pre-validated questionnaire was used to determine the knowledge and perspective of the study population towards artificial intelligence. Data obtained was subjected to statistical analysis using SPSS version 21.

Results: Among 279 study participants, 226 (81%) were undergraduate and 53 (19%) were postgraduate students. About 55.8% of undergraduate students and 77.4% of postgraduate students had reported that they are familiar with the uses and knowledge of AI. For an idea of how AI can be incorporated in dental practice, around 61% of undergraduate and 71.7% of postgraduate students responded positively. It showed postgraduate students had a higher knowledge about how AI can be incorporated in dental practice, this difference in opinion was found to be statistically significant ($p < 0.01$).

Conclusion: AI will be useful in planning diagnosis and treatment plans in the future by seeing responses from the respondents. Sensitization lectures should be organized to help dental students gain a better understanding of AI and ultimately help them play a fully conscious and active role in the development, implementation, and use of AI tools in dentistry.

Keyword: Artificial intelligence, dental students, knowledge.

Introduction:

The term “artificial intelligence” (AI) was coined in the 1950s and refers to the idea of building machines that are capable of performing tasks that are normally performed by humans. AI is defined as a field of science and engineering concerned with the computational understanding of what is commonly called intelligent behavior and with the creation of artifacts that exhibit such behavior.[1] Computer-based diagnosis is gaining momentum due to its ability to detect and diagnose lesions which may go unnoticed to the human eye, thereby paving way for a holistic practice. Machine learning (ML) is a subfield of AI, in which algorithms are applied to learn the intrinsic statistical patterns and structures in data, which allows for predictions of unseen data.[2]

AI programs that are designed to provide expert support for health professionals are known as Clinical Decision Support System (CDSS). They are designed to support health

care workers in their everyday duties, assisting with tasks that rely on the manipulation of data and knowledge. The systems include Artificial neural networks (ANNs), fuzzy expert systems, evolutionary computation and hybrid intelligent systems. Each AI technique has its own strengths and weaknesses. Neural networks are mainly concerned with learning, fuzzy logic with imprecision and evolutionary computation with search and optimization.[3]


AI is at an initial phase in dentistry now and yet far from reaching its full potential. Some of its uses are tooth localization for periapical dental X-ray images via convolution neural network, Automated segmentation of gingival diseases

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from oral images, Cephalometric landmark detection in dental X-ray images using convolutional neural technology [Accuracy is not mentioned], Classification of teeth in cone-beam CT using deep convolutional neural network (CNN), Classification of dental disease using CNN and transfer learning [Accuracy of 0.8846], Osteoporosis detection in panoramic radiographs using a deep CNN based computer-assisted diagnosis system: a preliminary study. AI programs can help in the tracing of cephalometric landmarks; in the detection of caries, alveolar bone loss, and periapical pathosis; the auto-segmentation of the inferior alveolar nerve; the analysis of facial growth, and other similar tasks.⁴

The pace of change shortly is expected to accelerate as tools improve and as demands for analyzing a rapidly growing body of knowledge and array of data increase. The medical students of today & future aspirants will practice in a world where information technology is sophisticated and ubiquitous.

India, being a technologically advancing country is yet to achieve its full potential. Dental students and researchers are not yet completely familiar with the concepts and true potential of AI, and the impact it can have on both our personal and professional lives. Therefore, the present study was conducted to evaluate the knowledge, attitude and practices regarding artificial intelligence (AI) among undergraduate and postgraduate dental students.

Material and Methods:

A descriptive, cross-sectional survey was conducted among undergraduate students (3rd year, final year, Interns) and postgraduate students in the dental institute of Sri Ganganagar, Rajasthan.

A 15 item pre – tested, pre - validated close-ended questionnaire⁵ was used to record the knowledge, attitude and practice regarding AI among the included participants. Total of 381 students, were approached for the research, out of which 279 duly filled questionnaires were received making the response rate about 74%. A description regarding the need to conduct the study was mentioned prior to the distribution of questionnaire to take the voluntary consent of the participants.

The survey consisted of 3 point Likert scale questions regarding participants' knowledge, attitude and practice toward AI, their opinions on directions of AI development, and their perceptions regarding the future of AI in oral radiology.

Data obtained from the study was subjected for statistical analysis using SPSS Version 21. Descriptive statistics were utilized for frequency distribution. A Comparison was done to assess the difference in knowledge, attitude, and future practice among undergraduate and postgraduate students using the Chi-square test. The level of significance was set at $p < 0.05$.

Results:

Gender distribution among the participants showed more female (63.8%) in comparison to male participants (36.2%). Out of the total participants, 226 (81%) were undergraduate dental students and 53 (19 %) were postgraduate students. (Table1)

Out of the total participants, 55.8 % of under graduate and 77.4% of postgraduate students had mentioned that they are familiar with the uses and knowledge of AI ($p < 0.01$). Although, 68.1% of undergraduate and 81.1% of postgraduate students agreed that AI has useful application in the dental field but the difference was found to be statistically non-significant ($p = 0.120$). For an idea of how AI can be incorporated in dental practice, around 61% of undergraduate students and 71.7% of postgraduate students responded positively. It showed postgraduate students had higher knowledge idea about how AI can be incorporated into a dental practice, this difference in opinion was found to be statistically significant ($p = 0.001$). (Table2)

Regarding the attitude towards the usage of artificial intelligence in dentistry, in terms of using software programs that can be helpful in radiological diagnosis, postgraduate students (96.2%) showed more interest in comparison to undergraduate students (82.7%), and this difference was found to be statistically significant ($p = 0.04$). In the comparison of response on diagnostic ability of AI in comparison to the clinical experience of a human doctor,

about 31% of under graduate students agreed positively as compared to postgraduate students (3.8%) and this difference was found to be statistically significant(p=0.001). Regarding the judgment of diagnosis, comparison among AI's judgement and self judgement, 60.4% of postgraduate students as compared to 54.9% undergraduate students reported that they will follow their own opinion. More postgraduate students (62.3%) were willing to recommend fellow practitioners to implement AI in their clinical practice as compared to under graduate students (53.5%). (Table 3)

Out of the total respondents, 71.7% of postgraduate and 66.8% of undergraduate students agreed that AI will help to evaluate minute details in radiographs which sometimes are missed by practitioners. Out of total respondents, 71.7% postgraduate and 57.5% undergraduate students showed interest in using AI while doing medical diagnoses in the future and this difference was found to be statistically significant(p=0.032). A Similar response rate was observed for using AI while making dental diagnosis and treatment planning in the future. A total of 50.9% of postgraduate students and 29.6% of undergraduate students agreed on introducing AI in specialized clinics first. The majority of both sections of respondents agreed that AI holds a bright future in India in near future. (Table 4)

Table 1: Demographic characteristics of the respondents

Variables	N (%)
Gender	
Male	101(36.2)
Female	178(63.8)
Educational Qualification	
UNDERGRADUATE	226(81)
POSTGRADUATE	53(19)

Table2. Educational qualification wise comparison of knowledge among dental students regarding artificial intelligence

Responses	Undergraduate N (%)	Postgraduate N (%)	Chi-square value	p-value
Are you familiar with the concept of artificial intelligence (AI) and its uses?				
Yes	126 (55.8)	41(77.4)	10.38	.006*
Not sure	67(29.6)	11(20.8)		
Maybe	33 (14.6)	1(1.9)		
Do you agree that AI has useful applications in the dental field?				
Yes	154(68.1)	43(81.1)	4.234	.120
Not sure	48(21.2)	5(9.4)		
Maybe	24(10.6)	5(9.4)		
Do you have any idea of how AI can be incorporated into dental practice?				
Yes	138(61)	38(71.7)	14.907	.001*
No	88(38.9)	15(28.3)		

*p ≤ 0.05 significant

Table3. Educational qualification wise comparison of Attitude among dental students regarding artificial intelligence

Responses	Undergraduate N (%)	Postgraduate N (%)	Chi-square	p-value
Would you like to use a software/program that can be helpful in radiological diagnosis?				
Yes	187 (82.7)	51 (96.2)	6.258	.044*
No	2 (0.9)	0		
Maybe	37 (16.4)	2 (3.8)		
Do you agree that the diagnostic ability of AI is better than the clinical experience of a human doctor?				
Yes	70 (31)	2 (3.8)	27.232	.0001*
No	55 (24.3)	30 (56.6)		
Maybe	101 (44.7)	21 (39.6)		
If your medical judgment and AI's judgments differ, which will you follow?				
My own opinion	134 (54.9)	32 (60.4)	0.557	.757
AI's opinion	32 (14.2)	7 (13.2)		
Not Sure	70 (31)	14 (26.4)		
Will you recommend fellow practitioners implement AI in their clinical practice?				
Yes	121 (53.5)	33 (62.3)	1.660	.436
No	2 (0.9)	0		
Maybe	103 (45.6)	20 (37.7)		

*p ≤ 0.05 significant

Table4. Educational qualification wise comparison of views on the future scope of artificial intelligence among dental students

Responses	Undergraduate N (%)	Postgraduate N (%)	Chi-square	P-value
Do you agree AI will help to evaluate minute details in radiographs which sometimes are missed by practitioners?				
Yes	151 (66.8)	38 (71.7)	3.981	.137
No	16 (7.1)	0		
Maybe	59 (26.1)	15 (28.3)		
Do you agree that you may use AI while doing medical diagnoses in the future?				
Yes	130(57.5)	38(71.7)	6.858	.032*
No	22(9.7)	0		
Maybe	74 (32.7)	15 (28.3)		
Do you agree that you may use AI while making dental diagnoses and treatment planning in the future?				
Yes	127(56.2)	30 (56.6)	3.656	.161
No	14 (6.2)	0		
Maybe	85 (37.6)	23 (43.4)		
In which field of dentistry do you think AI will be most useful?				
Making a diagnosis & treatment decision	108 (47.8)	17 (32.1)	4.749	.091
Direct treatment (including surgical robots)	76 (33.6)	21 (39.6)		
Interpreting complicated radiographic scans	52 (18.6)	15 (28.3)		
Which sector of health care do you think will be the first to commercialize AI?				
Public health centers	95 (42)	7 (13.2)	16.357	.0001*
Specialized clinics	67 (29.6)	27 (50.9)		
University hospitals	64 (28.3)	19(35.8)		
Do you think AI has a future in dentistry in India?				
Yes	141 (62.4)	31 (58.5)	6.221	.045*
No	18 (8)	0		
Maybe	67 (29.6)	22 (41.5)		
Do you think AI will help budding dentists in diagnosis and decision-making?				
Yes	159 (70.4)	41 (77.4)	4.046	.132
No	16 (7.1)	0		
Maybe	51 (22.6)	12 (22.6)		

*p ≤ 0.05 significant

Discussion:

Artificial intelligence (AI) is a technology, which has shifted from science fable into reality in the radiology practice in the last two decades. Allan Turner one of the founders of AI defined it as the ability to achieve human-level performance in cognitive tasks by computers. Implementation of AI in radiology is anticipated to significantly revolutionize the quality, value, and depth of radiology's contribution to patient

care and population health, and radiologists work flow in next decade.[3]

As many believe in this era of rapid advancement in AI technology, we are on the verge of a far-reaching shift in radiology that will profoundly affect practicing radiologists, trainees, other physician colleagues, and patients.[5] As seen in the present study, the identification of AI among the dental community was quite high and most of the dentists were familiar with it. Dentists favored AI and agreed that it can aid in radiological diagnosis in the future.

In the present study, the importance of AI among the dental student community was quite high and most students were well-informed about it. Most of the participants agreed that AI will be useful in dentistry in coming future. It was reported that both undergraduate and postgraduate knew about the concept of artificial intelligence (AI) and its uses and its application in the dental field but limited dental students were having knowledge about the incorporation of AI in dental practice. The results were in accordance with the study conducted by Jaideep et al.[5] The reason might be the fact that AI has been a source of great innovation and a prominent topic of discussion within radiological societies and groundbreaking research in recent years.[16]

A greater percentage of the study participants, showed a positive inclination towards the usage of software/program in radiological diagnosis. More than half of the total study population had a positive response regarding the recommendation of implementing AI to their fellow dentist in their clinical practice. Some of the participants differed to agree from the fact that the diagnostic ability of AI is better than the humans, and if there is conflict in diagnosis more than half of the total study participants will follow their own opinion. The results are similar to study done by Yüzbaşıoğlu et al.[9] which indicates that most of the dental students are aware of AI but the basic knowledge about working principles is low. This could be due to the fact that AI technology will have difficulties in replacing physicians or dentists. There are some challenges, such as AI cannot engage in high-level discussions with patients to gain trust, reassure them, express empathy[7] and although sensors that gather valuable information to assist with diagnosis, physicians will still be required for interpretation in ambiguous situations to

incorporate medical history, perform physical examinations and encourage further discussion.[8]

In the current study, a greater percentage of the study participants agreed that AI will help to evaluate minute details in radiographs and thus can be utilized in making diagnosis making it an inevitable part of diagnosis in the near future. The result is similar to the study done by Jaideep et al., where most of the participants were familiar with the concept of AI, while more dentists were optimistic that AI can be used in diagnosis and treatment planning and more affirmed that AI can have a future in India. This could be due to the fact that AI promising for the future for healthcare; despite its risks and potential quality assurance issues, tremendous changes are sure to occur in terms of how radiological services will be delivered in the future.[6]

Applications of AI in everyday life are growing leaps and bounds. Dentists have always been at the forefront of implementing a technology. AI will be useful in planning, diagnosis and treatment plan in the future by seeing positive responses from the participants who are the future practicing dentists. There is no doubt in the supremacy of integrating AI into practice, but it can never replace the role of a dentist since clinical practice is not only about diagnosing but also correlating with clinical findings and providing personalized patient care. Although AI can assist in numerous ways, final call has to be made by a dentist as dentistry is a multi-disciplinary approach. Lectures and seminars can be organized to make that the dental students gain a better understanding of AI and ultimately help them play a fully conscious and active role in the development, implementation, and use of AI tools in dentistry.

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