

## Knowledge Attitude and Practices of Dental Students and Dental Practitioners Towards Artificial Intelligence

M. Shiva Thulasi<sup>1</sup>, Bathula Sowjanya<sup>2</sup>, Dr. K. Sreenivasulu<sup>3</sup>, M. Rudra Kumar<sup>\*4</sup>

Submitted: 06/06/2022

Accepted: 10/09/2022

**Abstract: Background:** Artificial intelligence (A.I.) and its subsets, machine learning (ML) and deep learning (DL), have been developed to analyze complex data obtained from various sources using algorithms integrated into decision support systems (D.S.S.s). DL algorithms in dentistry are useful in various diagnostic and treatment modalities. However, very few literature follow-up surveys and multi-regional studies were conducted to explore the practice of A.I. by dental professionals. **Aim:** The present study aimed to evaluate the knowledge, attitude, and practices of dental students as well as dental practitioners toward artificial intelligence. **Methodology:** A 15-question survey was prepared and distributed through Google Forms among dental students and professionals across Tamil Nadu, India. It comprised various sections aiming to evaluate the knowledge, attitude, and practice toward A.I. and its potential applications in dentistry. **Results:** 200 dental students and professionals (101 female, 99 male) responded to the questionnaire. Of these, about 70% (interns), 78.97% (Post graduates), and 77.95% (Dentists with less than five years of experience) had basic knowledge about A.I. technologies. Only 39.5% ( $p < .05$ ) agreed A.I. has potential application both in the field of medicine and dentistry, but 53.5% ( $p < .05$ ) thinks A.I. cannot replace the role of the dentist either in patient management or diagnosis shortly. In addition, 53.5% are aware of the potential applications; 44% recommended A.I. to be included in the undergraduate and postgraduate dental curriculum. **Conclusion:** The present study results indicate that most dental students and practitioners with less than 5 year of experience are aware of A.I. but lack basic knowledge about incorporation and working models. Most participants emphasized that the basic working principles of A.I., such as data science and logical statistics, should be taught in dentistry as a part of the curriculum or as value-added courses during their clinical training. Thus demanding the need for better evidence-based teaching with the expanded application of A.I. tools in dental practice.

**Keywords:** Attitude, Clinical Decision Support System, Deep Learning, Dental Education, Surveys, and questionnaires.

### 1. Introduction

Artificial Intelligence (A.I.) combines the advances of computers or machines and informatics technologies to acquire intelligence to perform tasks that normally require human intellect [1]. In 1956, John McCarthy, popularly known as the "Father of Artificial Intelligence," coined A.I., constructed and developed computers or machines capable of carrying out tasks by analyzing the data based on individual preferences and achieving specific goals [2]. Over the years, A.I. and its subsets, machine learning (ML) and deep learning (DL), have been developed to analyze complex data obtained from various sources using algorithms integrated into decision support systems (D.S.S.s). Machine learning, a subset of A.I., can be used to learn the inherent patterns and structures in data for in-depth analysis and perform data functions using computer algorithms [1, 3]. ML algorithms

build models like Genetic algorithms (G.A.), and Artificial Neural networks (ANN) can read and inspect the data to implement various functions

Several DL models such as deep neural networks (D.N.N.), recurrent neural networks (R.N.N.), and convolutional neural networks (CNN) were widely used to perform various clinical tasks like image recognition, image quality enhancement in the field of image-based automated diagnosis [4-6]. In the field of dentistry, DL algorithms are a useful tool in tracing Cephalometric landmarks, tooth color selection, prosthetic defects and removable partial denture designs, diagnosis of temporomandibular disorders, pulpal and periapical disease, periodontal lesions, identification of tooth-root morphology, localization of tooth, and detection of radiolucent or cystic lesions [1, 6-8]

Several Studies have shown that students of health care delivery systems are not anxious or concerned about being substituted by A.I. and believe A.I. is a supportive tool to execute patient trials and for screening purposes [8, 9]. To the best of our knowledge, very few studies [10-12] were conducted to establish dental students' views and attitudes regarding the application of A.I. in India's dentistry field. Thus, the present study aimed to evaluate the knowledge, attitude, and practices of dental students as well as dental practitioners towards artificial intelligence.

<sup>1</sup>M.Tech Student, Department of Computer Science and Engineering, G. Pullaiah College of Engineering and Technology, (Autonomous), Kurnool. Email: mtulasi191297@gmail.com.

<sup>2</sup>Assistant professor, Department of Computer Science and Engineering, G. Pullaiah College of Engineering and Technology, Kurnool. Email: sowjanyaireddy1230@gmail.com

<sup>3</sup>Professor, Department of CSE, GPCET, Kurnool. Email: ksrinivasuluce@gpcet.ac.in

<sup>4</sup>Professor, Department of CSE, GPCET, Kurnool. Email: mrudrakumar@gmail.com

\* Corresponding Author Email: mrudrakumar@gmail.com

## 2. Methodology

A cross-sectional questionnaire survey was conducted amongst dental students and practitioners across Chennai city to assess their knowledge, attitude, and practice toward artificial intelligence (A.I.) After obtaining the Ethical clearance, the required information was collected through published scientific articles about the study, and self-administered structured questionnaires comprising 15 questions in the English language were prepared and evaluated. The questionnaire combined selected responses to certain questions and a few close-ended questions (Yes / No/don't know).

200 randomly selected dental students and practitioners across Chennai participated in this survey. Since this study was conducted during the COVID-19 Pandemic lockdown period, online Google forms were generated and distributed through social media platforms. The internal consistency of the questionnaire was adequate (Cronbach's alpha = 0.791). The tool's reliability was evaluated by test-re-test reliability analysis and Kappa statistic (0.83). All the participants were briefed about the purpose of the study, informed consent was obtained before the survey through Google forms, and they assured that their participation was purely voluntary.

### Statistical Evaluation

Non-probability, random sampling technique was employed that yielded information from 200 individuals taken into this observational study having a cross-sectional design. Responses recorded among the selected population group were evaluated using SPSS software Version 22.0. In the final analysis, "yes" or correct responses were given a score of 1, and "no" or incorrect responses were given a score of 0; the scores were summed to obtain the overall scores in Internship, Postgraduates, and Dental practitioners under five year of experience group

### Results

On analysis of the given data, the mean age of the study population was observed as  $26.08 \pm 4.1387$  years (mean  $\pm$  S.D) with 0.577 at a 95% confidence level comprising 99 (49.5%) male and 101 (50.5%) female participants. It was observed that 25% (50) of study participants are undergraduate students, 24.5% (49) are postgraduate students, followed by 22% (44) dental practitioners under ten years of experience, 20.5% (41) students pursuing an internship, 5% (10) are dental practitioners with 5-10 years of experience and the least being 3% (6) dental practitioners with more than 5 years of experience respectively. Chi-square test analysis was done to correlate the interrelationship between the year-wise distribution of the study participant. The result is significant at  $p < .05$

### Knowledge-Based Responses

On the evaluation of knowledge-based questions about artificial intelligence, it was observed that 34.5% (69) recognized John McCarthy established the concept of Artificial intelligence, among which only 41.5% (83) were familiar with both Artificial Neural networks (ANN) and convolutional neural networks (CNN) models. 53.5% (107) were also aware of the clinical decision support system (CDSS), commonly used as an adjuvant diagnostic tool in dentistry. The majority of the participants knew several A.I. applications, such as the Manufacturing sector (29%), Stock Market (34%), and Metrology (18.5). 50.5% (101) agree that insufficient knowledge and lack of awareness of the incorporation of A.I. in dental practice as the major drawbacks

### Attitude Based Responses

On the assessment of the participant's attitude, 29.5% (59) agree with the application of A.I. in the diagnosis of oral cavity lesions, 39.5% feel (79) A.I. has potential application both in the field of medicine and dentistry, and 50% (100) found a beneficial role in classifying suspicious altered mucosal lesions (Malignant changes). 40.5% (91) and 44.5% (89) does not have a positive attitude towards using software program for planning surgeries and predicting genetic predisposition; nonetheless, 53.5% (107) thinks A.I. can replace the role of dentist neither in patient management nor in diagnosis

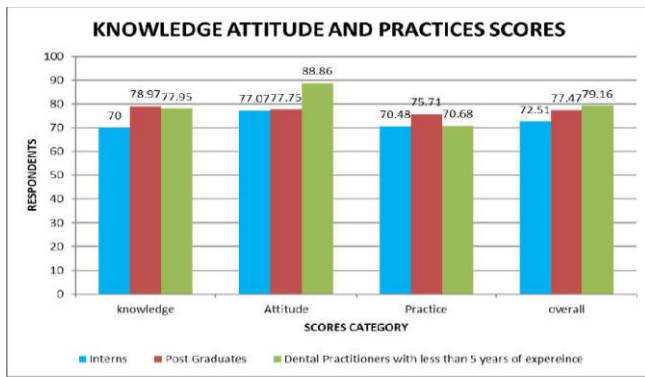
### Practice-Based Responses

On the estimation of practice-based questions, about 37.5% (75) suggest the use of A.I. integrated programs in radiological diagnosis as an excellent tool, among which 44% (88) recommend A.I. Program training sessions on data science (24.5%), Logic statistics (47%) for the radiologist to facilitate image-based automated diagnosis. 47% (94) practice A.I. to remove the necessity of several laboratory steps and ease the treatment procedures.

It was observed interns presented with 70% knowledge, 77.07% attitude, and 70.48% practice scores. In contrast, postgraduates responded with 78.97% knowledge, 77.75% attitude, and 75.71% practice scores, and Dental practitioners with less than five years of experience replied with 77.95% knowledge, 88.86% attitude, and 70.68% practice scores, respectively. The overall K.A.P. score was observed to be 72.51% for interns, 77.47% for postgraduates, and 79.16% for Dental practitioners with less than five years of experience, respectively, with a significant score of  $p < 0.0001$ , suggesting that scores improved with experience. [ Table 1 and Figure 1].

**Table 1: Responses To Questions**

S.no	Questions	Option	Total (n%)	P value
1	The concept of artificial intelligence was given by	John mc Carthy in 1956	69(34.5%)	0.00001
2	Do you agree that artificial intelligence has useful applications in the medical and dental fields?	Yes	79(39.5%)	0.00001
		No	96(48%)	
		Don't know	25(12.5%)	
3	Do you think artificial intelligence can replace the role of the dentist?	Yes	59(29.5%)	0.00001
		No	107(53.5%)	
		Don't know	34(17%)	
4	What are the studies of artificial intelligence?	Convolutional neural network	32(16%)	0.00001
		Artificial neural network	80(40%)	
		Both (a) and (b)	83(41.5%)	
		None of the above	5(2.5%)	
5	Do you suggest using this program in radiological diagnosis	Yes	75(37.5%)	0.00001
		No	101(50.5%)	
		Don't know	24(12%)	
6	Does radiologist requires training to access artificial intelligence in dentistry	Yes	88(44%)	0.00001
		No	97(48.5%)	
		Don't know	15(7.5%)	
7	What kind of training must be given?	Data Science	49(24.5%)	0.00001
		Logic statistics	94(47%)	
		No training requires	48(24%)	
		Don't know	9(4.5%)	
8	What are the conditions in which Artificial intelligence can be used as a modality in diagnosis and treatment?	Lesion of the oral cavity	59(29.5%)	0.00001
		Classifying suspicious altered mucosa	100(50%)	
		Both(a)and (b)	34(17%)	
		None of the above	7(3.5%)	
9	Do you think that artificial intelligence removes the necessity for making a patient impression as well as several laboratory steps	Yes	(47%)	0.00001
		No	(43%)	
		Don't know	(10%)	
10	Does artificial intelligence has an advantage in future	Yes	80(40%)	0.00001
		No	94(47%)	
		Don't know	26(13%)	
11	Do you have any idea of how artificial intelligence can be incorporated into dental practice	Yes	69(34.5%)	0.00001
		No	101(50.5%)	
		Don't know	30(15%)	
12	Do you think this software program assists the oral surgeon in planning surgeries	Yes	78(39%)	0.00001
		No	91(40.5%)	
		Don't know	31(15.5%)	
13	Do you think artificial intelligence predicts the genetic predisposition of oral cancer	Yes	80(40%)	0.00001
		No	89(44.5%)	
		Don't know	31(15.5%)	
14	Which of the following network act as an adjuvant in diagnostic	Artificial neural network (ANN)	66(33%)	0.00001



**Figure 1-** Group Distribution (Interns, Post Graduates, Dental Practitioners)

### 3. Discussion

Artificial intelligence is believed to have a greater impact on the future generation of diagnostic and treatment modalities in health care sectors. Several studies were carried out to evaluate the knowledge and attitude towards the development and future of A.I. among medical professionals [6,13-15]. Applications of A.I. programs in dentistry are unique and remarkable, particularly in the field of diagnostic medicine and radiology, which serves as an advantage for budding young dental practitioners. However, very few scientific resources or survey has been conducted among dental students and dental professionals on their attitudes towards A.I. in dental practice [10-12, 16]

Most dental students and practitioners with less than 5 years of experience were aware that AI and CDSS were commonly used as adjuvant diagnostic tools in dentistry but lacked basic knowledge about incorporation and working models. Dental students believe that A.I. will modernize the future of dentistry, although the majority of respondents did not agree that A.I. could replace the role of the dentist neither in patient management nor in diagnosis shortly, in contrast to previous studies by Yüzbaşıoğlu [1], Ranjana, et al. [10], Sur J et al. [12],

Oh, S et al. [16] conducted among dental students and professionals. This could be attributed to the fact that many study participants feel that physical examination, patient trust, empathy, and comfort play an important role apart from artificial sensors that gather accurate, relevant information to aid in diagnosis and treatment planning.

About half of the respondents were familiar with both Artificial Neural Network (ANN) and convolutional neural networks (CNN) models, and the majority of the participants had knowledge of several A.I. applications and recommended A.I. Program training sessions which suggests the active interest of respondents in new technologies such as A.I. and their willingness to learn. Participants emphasized that the basic working principles of A.I., such as data science and Logic statistics, should be taught in dentistry as a part of the curriculum or as value-added courses during their clinical training, as suggested in several similar literature studies [13,17,18] to gain adequate knowledge.

One-third of the participants agree with the application of A.I. in diagnosing oral cavity lesions, feel A.I. has potential application both in medicine and dentistry, and half of them found a beneficial role in classifying

suspicious altered mucosal lesions. Similar to studies by Yüzbaşıoğlu E [1], Yu and Kohane [3], Dos Santos DP [6] et al., Singh J et al. [11], and Sur J et al. [12] who observed significant ( $p < .05$ ) a positive attitude towards potential application of A.I. both in the field of medicine and dentistry. Literature studies have also shown many A.I. systems have been developed with deep learning algorithms to identify altered mucosal lesions, perform automated diagnosis of oral lesions [19], bone age assessment [20], detection and radiographic diagnosis of tooth caries [5, 21] and periodontal diseases [22].

Half of the respondents practice A.I. to remove the necessity of several laboratory steps and ease the treatment procedures, similar to observation by Singh J et al. [11] and Sur J et al. [12]. Hwang et al. [23], in their observation, also reported that the diagnostic precision of deep learning algorithms at a quicker rate has transformed aided diagnostics into a more interactive practice. These observations indicate that A.I. was preferred for its ability to obtain quick, high-quality real-time data and ease practices in health care services with minimal errors. Park et al. [24] and Mupparapu et al. [25] also illustrated the expanding application of A.I. quickly beyond text-based and image-based dental investigation and diagnosis influence the treatment outcome and eventually help better patient care.

Most dental students agree that the major drawbacks were insufficient knowledge and lack of awareness towards incorporating A.I. into dental practice. This was in contrast to Turkish study by Yüzbaşıoğlu E [1], Korean study by Oh S et al [16]. These observations could be due to different educational curricula and teaching strategies across diverse countries. Additionally, the selected participants included dental students and professionals with clinical experience who might have had different A.I. conceptualizations influencing the overall study outcome [26],[27],[28],[29].

### 4. Conclusion

The present study results indicate that most dental students and practitioners with less than 5 year of experience are aware of A.I. but lack basic knowledge about incorporation and working models. Most participants emphasized that the basic working principles of A.I., such as data science, Logic statistics, should be taught in dentistry as a part of the curriculum or as value-added courses during their clinical training. Thus demanding the need for better evidence-based teaching with the expanded application of A.I. tools in dental practice

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