**Original article**

# Attitude and Perception of Dental Students towards Artificial Intelligence

MOHAMMED ASMATAHASIN[1], K.V.N.R. PRATAP[2], T. MADHAVI PADMA[3], V. SIVA KALYAN[4], V. SRUJAN KUMAR[5]

[1]Student (BDS), Department of Public Health Dentistry, Mamata Dental College, Khammam, India
[2]Professor & HOD, Department of Public Health Dentistry, Mamata Dental College, Khammam, India
[3]Professor, Department of Public Health Dentistry, Mamata Dental College, Khammam, India
[4]Reader, Department of Public Health Dentistry, Mamata Dental College, Khammam, India
[5]Senior Lecturer, Department of Public Health Dentistry, Mamata Dental College, Khammam, India
Corresponding author: MOHAMMED ASMATAHASIN

**Abstract**

**Background-**Artificial intelligence has been a hot topic in the ever-evolving world of technology, as well as a source of ongoing criticism for a variety of ethical grounds. As the use of AI has grown exponentially in recent years, it was necessary to ascertain dental students' knowledge and attitudes towards the use of artificial intelligence in dentistry.

**Aim-**This study attempts to determine about dental students' knowledge and attitudes on the use of artificial intelligence in dentistry.

**Material and Methods-**A 22-question survey was sent to all dental students in a tertiary level teaching hospital across Khammam via Google Forms to collect required information. The survey questionnaire had several sections with the goal of assessing dental students' knowledge and attitudes towards AI and its potential uses in dentistry. The anonymity of the respondents was ensured, and the data collected from the questionnaire was statistically analysed using SPSS software. The survey was conducted in the month of June 2021.

**Results**- A total of 270 students responded to the questionnaire which was sent via social media websites with the response rate being 67.5%. Most of the students (89.63%) were familiar with the term artificial intelligence, with 77.04 % believing that AI will lead to major advancements in dentistry and 89.63% agreed about AI applications being included in undergraduate and postgraduate dental training.

**Conclusion-** Based on the current study results, students were aware of artificial intelligence and were optimistic about AI revolutionising dental practise in the future. As AI has the potential to influence future dental practise, more research into its applications and integration into dental curriculum is needed.

**Keywords:** Artificial intelligence, dentistry, dental students.

**Introduction:**

The human brain is the most fascinating and has been studied extensively. It is the most evolved and intellectual of all species on the planet, making it pre-eminent. The endeavour to use technology to imitate human intelligence dates back to the 1950s. As technology advances, it is geared towards making human life easier and more simple. Artificial intelligence (AI) is one such example of technological application. Artificial intelligence is simply machine mimicking human or simulation of human intelligence by machines, especially computers.[1] Many tasks have become simpler and easier as

a result of AI applications in everyday life. AI may be used for anything from simple chores like setting an alarm with the help virtual assistance to more difficult tasks like navigating through complex city streets and the possibilities are endless.

Artificial Intelligence is used all over the world, and its popularity has skyrocketed in recent years[2] due to the widespread availability of smartphones with artificial intelligence-based features such as virtual assistants, fingerprint recognition, voice recognition, and face recognition, among others.

 The application of artificial intelligence in healthcare has gained a lot of attention throughout the world[3]. The AI based applications are anticipated to bring about a lot of changes for the betterment of the healthcare systems along with improved patient care.[3]

From patient booking an appointment with the help of virtual assistant to early detection of health conditions and use as an effective treatment planning tool, to monitor patient's compliance to therapy, there are numerous exciting applications of artificial intelligence in healthcare.[4,5] Despite the fact that there aren't many significant AI applications in dentistry today, the future of AI in dentistry looks bright. AI can be implied for: Active data collection from wearables to determine overall health and active patient monitoring, as well as reducing time spent on record keeping. The use of digital imaging in the radiographic diagnosis[6,7] of periodontal disease and the detection of caries, among many others.[8]

Although the ethical prejudice against the use of AI in health care is a significant impediment, the optimism is greater today. The world changes on a daily basis, and 'today' is not the same as 'yesterday,' and 'tomorrow' has a lot of room for improvement.


**AIM**: To assess the attitude and perception of dental students towards use of artificial intelligence in dentistry.

**OBJECTIVES**:

1. To determine the attitude and perception of dental students towards the usage of artificial intelligence in dentistry according to gender.

2. To determine the attitude and perception of dental students towards the usage of artificial intelligence in dentistry based on year of study.

**Material and methods:**

 A cross-sectional study was carried out at the tertiary level teaching hospital across Khammam. A total of 270 Dental students, including III BDS, IV BDS, INTERNS and POSTGRADUATES responded to the pretested online questionnaire link for 22 questions sent via social media websites, along with a short note explaining the purpose of the study. The questionnaire consisted of demographic data like name, age and year of study. The first few questions assess the knowledge of dental students about artificial intelligence and the next few questions determine the attitude and perception of dental students towards artificial intelligence in dentistry and its future applications. Participants were asked to select one option from the answers provided against each question. Data from the filled questionnaires was compiled in a tabular form in Excel worksheet and evaluated for analysis. The sampling method used is convenience sampling. The statistical analysis was done using SPSS 20.00 version, chi square test was done to check the association and a p value of $<0.05$ was said to be statistically significant. The survey was completed in the month of June2021.

**Results:**

Out of 270 subjects, 82 (30.37%) of them belonged to 20-21 years of age, 127 (47.04%) of them belonged to 22-23 years of age, 40 (14.81%) of them belonged to 23-24 years of age and 21(7.78%) of them belonged to >= 25 years of age with a mean age of 24.6 and 3.03 as SD age. There were 49 (18.15%) male students and 221 (81.85%) of them were female students.73(27.04%) belonged to III BDS, 91 (33.70%) belonged to IV BDS, 77 (28.52%) were INTERNS and 29 (10.74%) were POSTGRADUATE students. The demographic data is depicted in table1.

Majority (89.63%) of them were aware of the term Artificial intelligence and most of them (62.59%) were aware of using AI in daily life. 74.44% of the students found the use of AI – helpful. 52.96% responded positively when asked about the basic knowledge about the working principle of AI. When asked about the source of information about the applications of AI, 67.41% stated social media (Facebook, Instagram), 14.07% stated – family and friends, 13.33% stated – newspaper and magazines and very few of them (5.19%) stated – lectures in universities. Only 43.70% of them were aware of usage of AI in dentistry (yes-43.70%, no-56.30%). Majority (77.04%) of the students responded that AI would lead to major advances in dentistry. When asked about AI replacing physicians and dentists in future, 41.48% were neutral, 37.78% did not agree that AI would replace them in future. The usage of AI in dentistry was found 'exciting' to 45.56% of students, also 45.56 % were 'neutral' about it and 8.89% found it 'a fantasy'. 83.33% of students believed that AI can be used for active data collection, effective patient monitoring, and reduce time for record keeping and 50.74% believed that AI can used as a 'definitive diagnostic tool'. It was widely agreed that AI can be used for Radiographic diagnosis of tooth decay and periodontal diseases (83.70%-yes and 7.04%-none), diagnosis of soft tissue lesions of the mouth (57.41%-yes; 18.15%-no),radiographic diagnosis of pathologies of jaws (68.52%-yes; 9.26%-no),3-D implant positioning (81.48%-yes; 18.52%-no). Despite having little awareness of AI, most students agreed (89.63 %) that it should be included in their curriculum.

Although there was no statistical difference across gender about knowing the term 'AI', 30 out of 49 males (61.22 %) agreed about knowing the basic working principle of AI, while it was 51.13% in females. Whereas females (45.70%) were more aware of applications of AI in dentistry than males (34.69%). Though statistically not significant, the females had more positive approach for AI applications than males. Based on year of study, the lower grade students though having little knowledge, almost equally agreed about inclusion of AI and its applications into dental training. Responses to the questions about attitudes and perceptions towards AI based on year of study are given in table3.

**Table1: Demographic profile of respondents**

| Demographic profile | No of students | % of students |
|---|---|---|
| Age in yrs | | |
| 20-21yrs | 82 | 30.37 |
| 22-23yrs | 127 | 47.04 |
| 23-24yrs | 40 | 14.81 |
| >=25yrs | 21 | 7.78 |
| Gender | | |
| Female | 221 | 81.85 |
| Male | 49 | 18.15 |
| Years of study | | |
| III BDS | 73 | 27.04 |
| IV BDS | 91 | 33.70 |
| Interns | 77 | 28.52 |
| PG | 29 | 10.74 |
| Total | 270 | 100.00 |

**Table 2:  Comparison of attitude and perception of dental students towards AI across gender and year of study:**

| | Gender | | | Year of study | | | | |
|---|---|---|---|---|---|---|---|---|
| | Female | Male | p-value | III BDS | IV BDS | INTERNS | POSTGRADUATES | p-value |
| AI will lead to major advances in medicine and dentistry | | | | | | | | |
| Yes | 173 (78.28%) | 35 (71.43%) | 0.5140 | 46 (63.01%) | 64 (7033%) | 73 (94.81%) | 25 (86.21%) | 0.0004 |
| No | 17 (7.69%) | 4 (8.16%) | | 11 (15.07%) | 5 (5.49%) | 3 (3.90%) | 2 (6.90%) | |
| No idea | 31 (14.03%) | 10 (20.41%) | | 16 (21.92%) | 22 (24.18%) | 1 (1.30%) | 2 (6.90%) | |

| AI will replace dentists or physicians in future | | | | | | | |
|---|---|---|---|---|---|---|---|
| Yes | 42 (19.00%) | 14 (28.57%) | 0.0110 | 12 (16.44%) | 21 (23.08%) | 17 (22.08%) | 6 (20.69%) | 0.6360 |
| No | 78 (35.29%) | 24 (48.98%) | | 26 (35.62%) | 36 (39.56%) | 26 (33.77%) | 14 (48.28%) | |
| Neutral | 101 (45.70%) | 11 (22.45%) | | 35 (47.95%) | 34 (37.36%) | 34 (44.16%) | 9 (31.03%) | |
| How do you find the use of AI in dentistry | | | | | | | |
| Exciting | 92 (41.63%) | 31 (63.27%) | 0.0190 | 35 (47.95%) | 37 (40.66%) | 36 (46.75%) | 15 (51.75%) | 0.8220 |
| A fantasy | 20 (9.05%) | 4 (8.16%) | | 4 (5.48%) | 10 (10.99%) | 7 (9.09%) | 3 (10.34%) | |
| Neutral | 109 (49.32%) | 14 (28.57%) | | 34 (46.58%) | 44 (48.35%) | 34 (44.16%) | 11 (37.93%) | |
| AI can be used for: | | | | | | | |
| Active data collection from wearables | 12 (5043%) | 3 (6.12%) | 0.0090 | 5 (6.85%) | 7 (7.69%) | 3 (3.90%) | 0 (0.00%) | 0.0590 |
| Effective patient monitoring | 4 (1.81%) | 6 (12.24%) | | 7 (9.59%) | 1 (1.10%) | 2 (2.60%) | 0 (0.00%) | |
| Reduce time for record keeping | 8 (3.62%) | 3 (6.12%) | | 4 (5.48%) | 6 (6.59%) | 1 (1.30%) | 0 (0.00%) | |
| All the above | 190 (85.97%) | 35 (71.43%) | | 55 (75.34%) | 73 (80.22%) | 68 (88.31%) | 29 (100.00%) | |
| none | 7 (3.17%) | 2 (4.08%) | | 2 (2.74%) | 4 (4.40%) | 3 (3.90%) | 0 (0.00%) | |

| AI can be used as a "prognostic tool" to | | | | | | | |
|---|---|---|---|---|---|---|---|
| Predict the course of disease | 22 (9.95%) | 3 (6.12%) | 0.3480 | 8 (10.96%) | 8 (8.79%) | 7 (9.09%) | 2 (6.90%) | 0.6500 |
| Determine the chance of recovery | 5 (2.26%) | 3 (6.12%) | | 3 (4.11%) | 3 (3.30%) | 2 (2.60%) | 0 (0.00%) | |
| All the above | 175 (79.19%) | 37 (75.51%) | | 54 (73.97%) | 68 (74.73%) | 64 (83.12%) | 26 (89.66%) | |
| None | 19 (8.60%) | 6 (12.24%) | | 8 (10.96%) | 12 (13.19%) | 4 (5.19%) | 1 (3.45%) | |
| **AI can be used for:** | | | | | | | |
| Radiographic diagnosis of tooth decay | 12 (5.43%) | 3 (6.12%) | | 4 (5.48%) | 7 (7.69%) | 2 (2.60%) | 2 (6.90%) | 0.2920 |
| Radiographic diagnosis of periodontal diseases | 6 (2.71%) | 4 (8.16%) | | 4 (5.48%) | 4 (4.40%) | 2 (2.60%) | 0 (0.00%) | |
| All the above | 187 (84.62%) | 39 (79.59%) | | 54 (73.97%) | 68 (74.73%) | 64 (83.12%) | 26 (89.66%) | |
| None | 16 (0.00%) | 3 (6.12%) | | 8 (10.96) | 12 (13.19%) | 4 (5.19%) | 1 (3.45%) | |
| **AI can be used for soft tissue lesion diagnosis** | | | | | | | |
| Yes | 128 (57.92%) | 27 (55.10%) | 0.8940 | 33 (45.21%) | 43 (47.25%) | 60 (77.92%) | 19 (65.52%) | 0.0001 |
| No | 39 (17.65%) | 10 (20.41%) | | 11 (15.07%) | 16 (17.58%) | 16 (20.78%) | 6 (20.69%) | |
| No idea | 54 (24.43%) | 12 (24.49%) | | 29 (39.73%) | 32 (35.16%) | 1 (1.30%) | 4 (13.79%) | |

| AI can used in radiographic diagnosis of pathologies in the jaw | | | | | | | |
|---|---|---|---|---|---|---|---|
| Yes | 155 (7014%) | 30 (61.22%) | 0.1580 | 39 (53.42%) | 50 (54.95%) | 70 (90.91%) | 26 (89.66%) | 0.0001 |
| No | 17 (7.69%) | 8 (16.33%) | | 9 (12.33%) | 10 (10.99%) | 5 (6.49%) | 1 (3.45%) | |
| No idea | 49 (22.17%) | 11 (22.45%) | | 25 (34.25%) | 31 (34.07%) | 2 (2.60%) | 2 (6.90%) | |
| AI can be used in 3D positioning of implant | | | | | | | |
| Yes | 180 (81.45) | 40 (81.63%) | 0.9760 | 60 (82.19%) | 69 (75.82%) | 64 (83.12%) | 27 (93.10%) | 0.1960 |
| No | 41 (18.55%) | 9 (18.37%) | | 13 (17.81%) | 22 (24.18%) | 13 (16.88%) | 2 (6.90%) | |
| AI can be used in forensic dentistry | | | | | | | |
| Yes | 198 (89.59%) | 41 (83.67%) | 0.2400 | 63 (86.30%) | 76 (83.52%) | 71 (92.21%) | 29 (100.00%) | 0.0610 |
| No | 23 (10.41%) | 8 (16.33%) | | 10 (13.70%) | 15 (16.48%) | 6 (7.79%) | 0 (0.00%) | |
| AI should be part of UG&PG dental training | | | | | | | |
| Yes | 200 (90.50%) | 42 (85.71%) | 0.3200 | 64 (87.67%) | 76 (83.52%) | 75 (97.40%) | 27 (93.10%) | 0.0250 |
| No | 21 (9.50%) | 7 (14.29%) | | 9 (12.33%) | 15 (16.48%) | 2 (2.60%) | 2 (6.90%) | |

**Table 3: Comparison of knowledge of dental students towards AI across gender and year of study:**

| | Gender | | | Year of study | | | |
|---|---|---|---|---|---|---|---|
| | Female | Male | p-value | III BDS | IV BDS | INTERNS | POSTGRADUATE |
| Heard of term AI | | | | | | | |
| Yes | 198 (89.59%) | 44 (89.80%) | 0.9660 | 67 (91.78%) | 76 (83.52%) | 72 (93.51%) | 27 (93.10%) |
| No | 23 (10.41%) | 5 (10.20%) | | 6 (8.22%) | 15 (16.48%) | 5 (6.49%) | 2 (6.90%) |
| Aware of using AI | | | | | | | |
| Yes | 140 (63.35%) | 29 (59.18%) | 0.7340 | 41 (56.16%) | 53 (58.24%) | 56 (72.73%) | 19 (65.52%) |
| No | 39 (17.65%) | 11 (22.45%) | | 13 (17.81%) | 17 (18.68%) | 16 (20.78%) | 4 (13.79) |
| No idea | 42 (19.00%) | 9 (18.37%) | | 19 (26.03%) | 21 (23.08%) | 5 (6.49%) | 6 (20.69%) |
| Find the use of AI | | | | | | | |
| Helpful | 164 (74.21%) | 37 (75.51%) | 0.5250 | 53 (72.60%) | 70 (76.92%) | 56 (72.73%) | 22 (75.86%) |
| Boring | 7 (3.17%) | 3 (6.12%) | | 2 (2.74%) | 6 (6.59%) | 2 (2.60%) | 0 (0.00%) |
| neutral | 50 (22.62%) | 9 (18.37%) | | 18 (24.66%) | 15 (16.48%) | 19 (24.68%) | 7 (24.14%) |
| Basic knowledge about working principle of AI | | | | | | | |
| Yes | 113 (51.13%) | 30 (61.22%) | 0.2000 | 42 (57.53%) | 50 (54.95%) | 37 (48.05%) | 14 (48.28%) |
| No | 108 (48.87%) | 19 (38.78%) | | 31 (42.47%) | 41 (45.05%) | 40 (51.95%) | 15 (51.72%) |

| Information source about AI applications | | | | | | |
|---|---|---|---|---|---|---|
| Newspaper, magazines | 29 (13.12%) | 7 (14.29%) | 0.9800 | 9 (12.33%) | 15 (16.48%) | 9 (11.69%) | 3 (10.34%) |
| Family, friends | 31 (14.03%) | 7 (14.29%) | | 12 (16.44%) | 10 (10.99%) | 13 (16.88%) | 3 (10.34%) |
| Social media (Facebook, Instagram) | 150 (67.87%) | 32 (65.31%) | | 46 (63.01%) | 60 (65.93%) | 53 (68.83%) | 23(79.31%) |
| Lectures in university | 11 (4.98%) | 3 (6.12%) | | 6 (8.22%) | 6 (6.59%) | 2 (2.60%) | 0 (0.00%) |
| Aware of usage of AI in dentistry | | | | | | |
| Yes | 101 (45.70%) | 17 (34.69%) | 0.1600 | 34 (46.58%) | 43 (47.25%) | 29 (37.66%) | 12 (41.38%) |
| No | 120 (54.30%) | 32 (65.31%) | | 39 (53.42%) | 48 (52.75%) | 48 (62.34%) | 17(58.62%) |

**Discussion**

Artificial intelligence, as a possible technological advancement, has numerous uses in healthcare, particularly dentistry. In the research done previously, it was revealed that the potential to create a revolutionary way of practicing evidence based personalized medicine is being offered by the combination of AI, big data, and massively parallel computing methods (B. X. Tran et al., 2019). In this survey students were aware of the AI but the basic knowledge about working principle is low, which is similar to the study conducted among Turkey dental students[9] and Korean study[10]. AI with deep learning algorithms [11], identify lesions and carryout measurements for diagnosis of the condition[11.] Majority of the students agreed about AI applications revolutionizing the future dental practice. However when asked about AI replacing themselves only 37.78% disagreed and 41.48% felt neutral about it.

According to this study 20.74% students agreed about AI potentially replacing dentists, which was not similar to the study – in which it was found that the public is about twice as likely to express worry (72%) than enthusiasm (33%) about a future where machines (computers and robots) doing human jobs.[12] Most of the results from the previous literature are more or less similar to the result of this survey. Although scientific studies are increasing, the results of this study clearly shows that students lack basic knowledge about AI and also it shows their interest towards learning about AI and its potential future applications as a new technology.

**Conclusion**

According to the findings, around 77.4 % of survey participants were aware that artificial intelligence in dentistry is useful, and both male and female students were equally aware of artificial intelligence. As a whole, females were more optimistic about AI applications in dentistry than males and lower grade students were almost equally enthusiastic as higher grade about AI in dentistry. Because AI has

the ability to evolve into a cutting-edge platform capable of evaluating increasingly complicated medical data, greater awareness is required for a better understanding and analysis of the data[1]. Hence there is a need for organising seminars, lectures and workshops for dental students to gain more understanding towards AI and its applications.

**References:**

1. Shapiro SC. Encyclopedia of Artificial Intelligence2nd ed., Vols and  New York: Wiley;

2. Morris KC, Schlenoff C, Srinivasan V. A remarkable resurgence of artificial intelligence and its impact on automation and auton-omy. IEEE Trans Autom Sci Eng.

3. Hinton G. Deep learning: a technology with the potential to transform health care. JAMA

4. Miotto R, Wang F, Wang S, Jiang X, Dudley JT. Deep learning for healthcare: review, opportunities and challenges. Brief Bioin-form;.

5. Xiao C, Choi E, Sun J. Opportunities and challenges in develop-ing deep learning models using electronic health records data:a systematic review. J Am Med Inform Assoc.

6. Yu KH, Kohane IS. Framing the challenges of artificial intelli-gence in medicine. BMJ Qual Saf.

7. Tang A, Tam R, Cadrin-Chênevert A, et al. Canadian associationof radiologists white paper on artificial intelligence in radiology.Can Assoc Radiol J.

8. Beregi JP, Zins M, Masson J-P, et al. Radiology and artificialintelligence: an opportunity for our specialty. Diagn Interv Imag-ing.

9. Yüzbasioglu E. Attitudes and perceptions of dental students towards artificial intelligence. J Dent Educ. 2020;1-9.

10. Oh S, Kim JH, Choi SW, Lee HJ, Hong J, Kwon SH. Physicianconfidence in artificial intelligence: an online mobile survey.J Med Internet Res.

11. Lee JH, Kim DH, Jeong SN, Choi SH. Detection and diagnosis ofdental caries using a deep learning-based convolutional neuralnetwork algorithm. JDent.

12. Pinto Dos Santos D, Giese D, Brodehl S, et al. Medical students'attitude towards artificial intelligence: a multicentre survey. EurRadiol.