ORIGINAL ARTICLE

# Knowledge, Attitudes and Perceptions Regarding Artificial Intelligence and its Uses in Oral Radiology Among Dental Surgeons of Lahore

**Shahzada Faiz Ahmad Khan**[1] **BDS, BS, FCPS, CHPE**
**Muhammad Asif Shahzad**[2] **BDS, BS, FCPS, CHPE**
**Ayma Syed**[3] **BDS, M.Phil**
**Ghulam Mohammad Paracha**[4] **BDS**
**Lubna Yousaf**[5] **BDS, MPH**
**Maleeha Naseer**[6] **BDS, FCPS**

**OBJECTIVE:** To assess the knowledge, attitudes and perceptions of dentists in Lahore regarding the emergence of artificial intelligence (AI) and its future applications in the field of oral radiology.
**METHODOLOGY:** A total of 300 dentists participated in our study. Data collection was done by sending Google forms to dental surgeons in Lahore. This descriptive study was carried out after approval from the ethical review committee of Azra Naheed Dental College, Lahore from July 2023 to February 2024. There were no age restrictions or gender discrimination in this study.
**RESULTS:** Out of the 300 dentists who participated in the study, about 80% were already having the concept regarding AI and familiar with it, 70% agreed to the fact that they plan and expect to use AI for making clinical diagnoses, 53% agreed that the interpretation of complex radiographic cases would be the prime and key function of AI, and 56% were in agreement that AI in future would have a promising role in Pakistan.
**CONCLUSION:** It was concluded in our study that dental professionals are familiar with AI concepts.
**KEYWORDS:** Artificial intelligence, Oral x-rays, Lahore, Dentists
**HOW TO CITE:** Khan SFA, Shahzad MA, Syed A, Paracha GM, Yousaf L, Naseer M. Knowledge, attitudes and perceptions regarding artificial intelligence and its uses in oral radiology among dental surgeons of Lahore. J Pak Dent Assoc 2025;34(1): 17-21.
**DOI:** https://doi.org/10.25301/JPDA.341.17
*Received: 23 October 2024, Accepted: 09 April 2025*

## INTRODUCTION

Healthcare industry has been undergoing a technological revolution for quite some time. Our field experienced a major breakthrough when we transitioned from operating without X-rays to using them. Improved patient care and more efficient practice management have been achieved through technological progress. It is crucial to stay up-to-date with the latest technological advancements as they offer numerous benefits.[1]

The capacity for human intelligence refers to the mental abilities that humans possess. Artificial intelligence is the term for machines, especially computers, that can imitate human thinking. In a nutshell, artificial intelligence is the creation of such machines that can perform tasks which would usually require human intelligence. The AI systems are widely utilized in numerous sectors, such as IT, manufacturing, dentistry, medicine, and meteorology. Data from diverse sources has been examined by AI programs.[1,2]

Many individuals, such as doctors and researchers, still require time to understand the principles, actual abilities, and potential impacts of AI on our professional and personal lives.[3]

The application of artificial intelligence in dentistry is quite captivating and intriguing, especially in the field of

1. Assistant Professor, Department of Oral and Maxillofacial Surgery, Azra Naheed Dental College, Lahore.
2. Professor and Head Department of Oral and Maxillofacial Surgery, Azra Naheed Dental College, Lahore.
3. Professor and Head Department of Community & Preventive Dentistry, Azra Naheed Dental College, Lahore.
4. Demonstrator, Department of Oral and Maxillofacial Surgery, Azra Naheed Dental College, Lahore.
5. Assistant Professor, Department of Community & Preventive Dentistry, Avicenna Dental College, Lahore.
6. Senior Registrar, Department of Oral and Maxillofacial Surgery, Azra Naheed Dental College, Lahore.

**Corresponding author: "Shahzada Faiz Ahmad Khan"**
< ahmad.afghan56@gmail.com >

oral radiology and it could be a great advantage for aspiring dental professionals in their clinical practice.[4] The AI systems can assist the dentists in various tasks related to the facial growth, dental implants, inferior alveolar nerve and other areas, such as automatically dividing the nerve, studying the face, and finding dental problems like cavities[5], bone loss[6], and infections around the tooth.[7] Research has shown that AI can be utilized in the diagnosis and early identification of metastases regarding cervical lymph nodes[8] and oral cancer[9], as well as may aid in diagnosis and treatment planning of therapy for several orofacial disorders.[10] For quite some time, the utilization of artificial intelligence in healthcare has been met with doubt and uncertainty. Some believe that the introduction of new technologies will enhance healthcare, while others argue that it will render radiologists and pathologists obsolete.[11,12]

In this regard, we were compelled that a study should be conducted in a developing country like Pakistan to assess the knowledge, attitudes and perceptions of dentists in Lahore regarding the emergence of artificial intelligence (AI) and its future applications in the field of oral radiology.

## METHODOLOGY

A total of three hundred dental professional participated in our study (Table 1). The study was carried out from July 2023 to February 2024 after approval from the ethical review committee of Azra Naheed Dental College, Lahore vide ERB no ANDC/RAC/2023/46. This study was having no limitation or discriminations for age and gender respectively.

**Table 1:**

| Inclusion criteria | Exclusion criteria |
|---|---|
| 1. Studies reporting from Jan 2017---2022 (5 years)<br>2. Reviews published in the English language only | 1. Animal studies, narrative reviews<br>2. Articles involving medically compromised patients |

We used a computer program to find and add Booleans and keywords to our search results, which are stored in a database of Google and PubMed (Medline). The articles that were published within the last five years were examined and selected on the basis of criteria for inclusion and exclusion. Information was gathered through google forms with 15 questions of close ended type that could be answered with a simple yes or no.

The questionnaire had three sections regarding the knowledge, attitudes, and future. Of the three, the first section of the survey consists of four questions that measure how well the participants understand and comprehend about AI. The following section of the questionnaire had four questions that aimed to assess the attitudes of dentists towards AI. The final section of the survey contains seven questions about the potential future of the AI applications and its uses in oral radiology among the dental professionals in Lahore, Pakistan. The information and data collected through google forms was analyzed by using IBM SPSS software version 22 was also utilized. Due to descriptive nature of the study, no inferential test was applied.

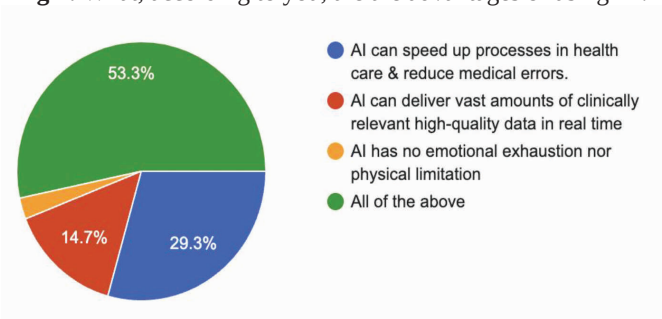
## RESULTS

Three hundred dental surgeons completed the survey questionnaire.

*Knowledge*

The dentists had a very high level of understanding about AI (Fig.1). Out of the three hundred individuals who took part in the event, 80% had prior knowledge of the AI framework. While most agreed (75%) that AI can be useful

**Fig 1:** What, according to you, are the advantages of using AI?




in medical applications, however only a few knew (15%) how to integrate and use AI in dental practice. Additionally, 29% recognized that AI can enhance the healthcare system by reducing errors and increasing data quantity and quality without human or physical exhaustion and within a shorter timeframe.

*Attitude*

Most of the dental surgeons (95%) would prefer to utilize a software that could be beneficial and helpful in radiological diagnosis (Fig. 2). Only 20% of dental professionals believed that the AI would outperform a human doctor in diagnosis, while the majority (80%) were uncertain or ultimately denied the fact (Fig.3). If there is a disagreement in diagnosis, 15% of dentists said they would trust AIs prediction, whereas the rest either remained uncertain or relied on their own judgment (Fig.4). In addition, 64% of the dentists who took part in the survey expressed their willingness to advise other dentists to use AI in their clinical practice.

**Fig 2:** Do you want to utilize a program/software that can aid in the process of radiological diagnosis?

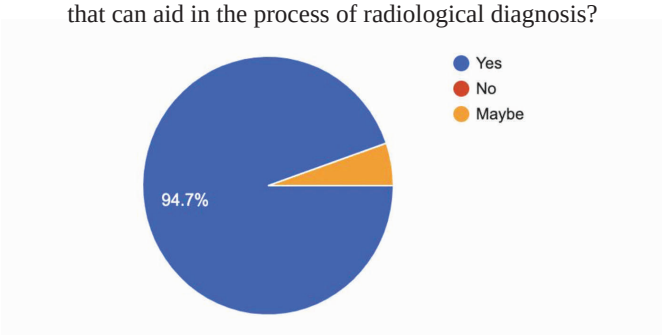



**Fig 3:** Would you agree that Als diagnostic skills surpass those of a human dental professional clinical experience?

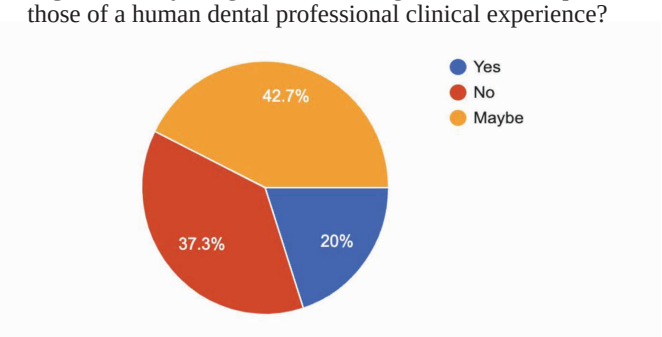
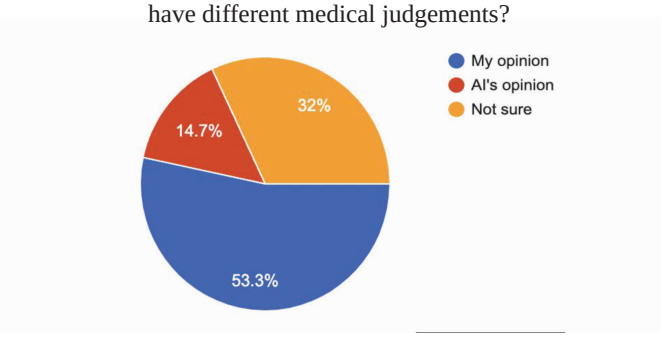


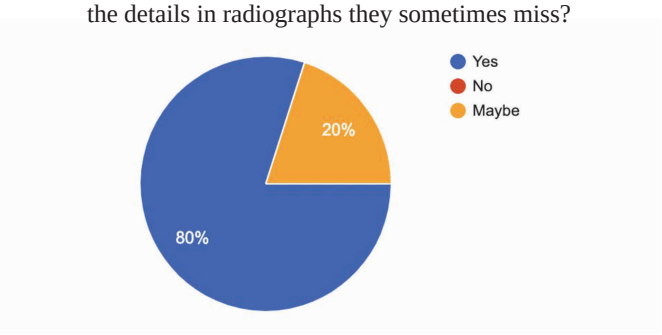

**Fig 4:** Which will you follow, if you and Al have different medical judgements?




*Future*

80% of dentists believe that artificial intelligence AI could assess even subtle details in radiographs that dentists may sometimes miss. (Figure 5). About 69%, 53%, and 45% of dentists agreed that they would prefer to use AI for diagnosis of dental lesions, complex X-ray interpretation,

**Fig 5:** Do you agree that AI will help doctors in understanding the details in radiographs they sometimes miss?




and it may prove helpful in early diagnosis and detection of oral cancer. However, only 32% and 19% of dentists believe they will use robots for immediate treatment and AI for treatment planning (Figure 6).

**Fig 6:** In which areas and fields of dentistry that you think AI will be the most helpful and useful for dentists? (Choose as many)

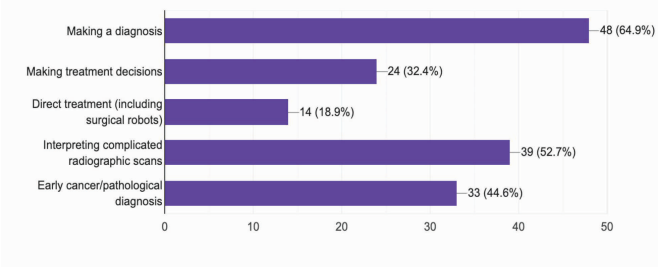



**Fig 7:** Which medical field do you think will commercialize AI first?

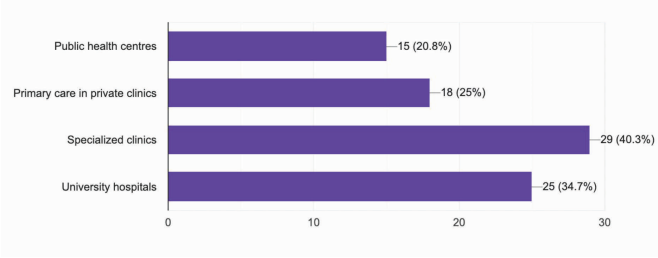



**Fig 8:** Do you think Al has a future in Pakistani dentistry?

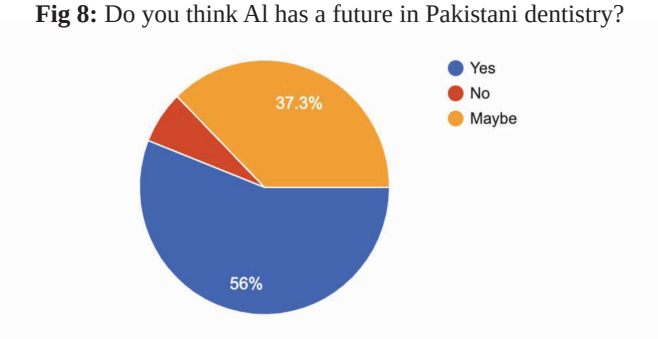
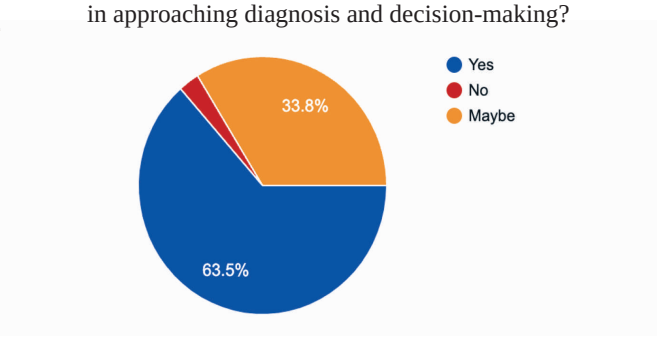



**Fig 9:** Do you think Al would help novice dentists in approaching diagnosis and decision-making?




40% supported to utilize the AI in specialized dental clinics (radiology centers, orthodontic and prosthodontic clinics), 35% were in agreement to use the AI in academic hospitals, and 21% supported the use of AI in public health

centers, while 25% of the dentists approved the use of AI for primary care in private practices. (Figure 7). In total, 56% of dentists believe that artificial intelligence has a future in Pakistan. In comparison, 64% of respondents believe that the AI would assist and support novice dentists in approaching proper diagnosis and decision-making (Figure 8).

## DISCUSSION

Our study was the first survey-based study conducted in Pakistan to explore knowledge, attitudes and perceptions of dental professionals about the future of AI in dentistry. The majority (80%) of dental professionals were aware of artificial intelligence, which is widely accepted in the dental community. Most of them (75%) knew that AI would bring significant benefits to the healthcare sector. However, more than 55% of respondents were uncertain about how to implement AI in dental clinics. When asked how AI could assist doctors, 30% said it would speed up key procedures and processes while making it easier to interpret complex X-ray images. They found it particularly useful because it has no restrictions and can provide high-quality data in seconds.

Oh et al[12] conducted a survey of Korean healthcare professionals to determine their awareness and opinions regarding AI. Only 6% of the 669 study participants were aware of the idea of AI, of them 83.4% agreed on its usefulness in the medical and dental field whereas 43.9% believed that diagnostic capabilities of AI were better than humans. According to respondents, the benefits of using AI include the ability to rapidly collect large amounts of data relevant to clinical significance, high quality data acquisition in real time (62.3%), speeding up medical processes (19.1%), and reducing medical errors (9.6%).

According to Pakdemirli et al[11], artificial intelligence has recently generated significant innovations, becoming a hot topic in the radiology community and has led to groundbreaking in the field of research. The future of healthcare sector seems bright and despite the risks and potential quality assurance issues, there is no doubt that significant changes will occur in the way radiological treatments are delivered.

This study revealed that an overwhelming majority of dentists (95%) believed that AI could help them with radiological diagnosis; however, 57% did not think this software could outsmart dentists, and more than half (53%) were believed that they would rely on their judgement in the case that it differed from the software.

According to Hwang et al[3], as the diagnostic accuracy and precision of deep learning algorithms in the medical field approaches that of human diagnosis, diagnostic assistance is evolving from a "second opinion" approach to a more interactive procedure. According to Hosny et al[13], AI capabilities can automatically identify complicated patterns in image data and provide numerical and quantitative instead of subjective evaluations regrading radiographical parameters. Likewise, Wong et al[14] argued that artificial intelligence has the ability and potential to transform the field of contemporary clinical radiology and it is essential to keep abreast with new advances. Radiologists will be able to benefit from the increased efficiency of AI to perform more tasks, increase their impact on relevant patients and play a key role in multidisciplinary clinical teams.[15]

Most dentists believed that with the advent of AI, AI would be used in diagnosis, decision making and treatment planning in the future as demonstrated by a number of researchers.[16,17] About half of dentists would like to use artificial intelligence for pathological diagnosis and direct X-ray imaging as highlighted by other investigators.[18,19] However, only a minority of respondents said they would be comfortable in letting AI do direct treatments using robots along with some other concerns.[11,12] This shows a clear lack of confidence in the capabilities of advanced artificial intelligence systems, although capabilities are sure to improve as the technology becomes more widespread in the coming years.

Ahmad et al[20] elaborated in detail about the use of robots and what the future holds for these technologies in various professional fields.

According to Park et al[21], the AI's use in dental field is rapidly outpacing text- and image-based procedures. The AI role in dentistry will expand, as its use in the healthcare sector increases. Mupparapu et al[22] argue that the purpose of AI may not have been to substitute the dental healthcare professionals, but that dentists could utilize and benefit from the AI technology to instantly obtain a second opinion which ultimately could help in diagnosis and benefit the patients.

Different dentists may have different perspectives on the usefulness of AI. However, the main limitation of our study is the small sample size, primarily consisting of dentists in Lahore. Therefore, larger-scale studies should be conducted in the future to enhance statistical accuracy and precision.

## CONCLUSION

Pakistani dentists are familiar with AI and agree that it can help in radiological diagnosis. Most agree that this can help analyze complex radiographs, improves diagnostic accuracy, reduces errors, and could leads to more reliable and accurate diagnosis of many maxillofacial diseases. Moreover, it is recommended that future studies investigate the utility and accuracy of artificial intelligence systems

in various dental fields with larger sample sizes for more detailed analysis.

## CONFLICT OF INTEREST

There was no conflict of interest among any of the authors.

## REFERENCES

1. Nagi R, Aravinda K, Rakesh N, Gupta R, Pal A, Mann AK. Clinical applications and performance of intelligent systems in dental and maxillofacial radiology: a review. Imaging Sci Dent 2020; 50: 81-92. *https://doi.org/10.5624/isd.2020.50.2.81*

2. ZhangZ, SejdicE. Radiological images and machine learning:Trends, perspectives, and prospects. Comput Biol Med 2019;108:354-70. *https://doi.org/10.1016/j.compbiomed.2019.02.017*

3. Hwang JJ, Jung YH, Cho BH, Heo MS. An overview of deep learning in the field of dentistry. Imaging Sci Dent. 2019;49:1-7. *https://doi.org/10.5624/isd.2019.49.1.1*

4. Ghods K, Azizi A, Jafari A, Ghods K. Application of Artificial Intelligence in Clinical Dentistry, a Comprehensive Review of Literature. J Dent (Shiraz). 2023;24:356-371.

5. Casalegno F, Newton T, Daher R, Abdelaziz M, Lodi-Rizzini A, Schürmann F, et al. Caries detection with near-infrared transillumination using deep learning. J Dent Res 2019; 98: 1227-33. *https://doi.org/10.1177/0022034519871884*

6. Thanathornwong B, Suebnukarn S. Automatic detection of periodontal compromised teeth in digital panoramic radiographs using faster regional convolutional neural networks. Imaging Sci Dent 2020; 50: 169-74. *https://doi.org/10.5624/isd.2020.50.2.169*

7. Orhan K, Bayrakdar IS, Ezhov M, Kravtsov A, Özyürek T. Evaluation of artificial intelligence for detecting periapical pathosis on cone-beam computed tomography scans. Int Endod J 2020; 53: 680-9. *https://doi.org/10.1111/iej.13265*

8. Contrast-enhanced computed tomography image assessment of cervical lymph node metastasis in patients with oral cancer by using a deep learning system of artificial intelligence. Oral Surg Oral Med Oral Pathol Oral Radiol 2019;127:458-63. *https://doi.org/10.1016/j.oooo.2018.10.002*

9. Ilhan B, Lin K, Guneri P, Wilder-Smith P. Improving oral cancer outcomes with imaging and artificial intelligence. J Dent Res 2020;99:241-8. *https://doi.org/10.1177/0022034520902128*

10. Welikala RA, Remagnino P, Lim JH, Chan CS, Rajendran S, Kallarakkal TG , et al. Automated detection and classification of oral lesions using deep learning for early detection of oral cancer. IEEE Access 2020;8:132677-93. *https://doi.org/10.1109/ACCESS.2020.3010180*

11. Pakdemirli E. Artificial intelligence in radiology: friend or foe? Where are we now and where are we heading? Acta Radiol Open. 2019;8:2058460119830222. *https://doi.org/10.1177/2058460119830222*

12. Oh S, Kim JH, Choi SW, Lee HJ, Hong J, Kwon SH. Physician confidence in artificial intelligence: an online mobile survey. J Med Internet Res. 2019;21:e12422. *https://doi.org/10.2196/12422*

13. Hosny A, Parmar C, Quackenbush J, Schwartz LH, Aerts HJ. Artificial intelligence in radiology. Nat Rev Cancer. 2018;18:500-510. *https://doi.org/10.1038/s41568-018-0016-5*

14. Wong SH, Al-Hasani H, Alam Z, Alam A. Artificial intelligence in radiology: how will we be affected? Eur Radiol. 2019;29:141-143. *https://doi.org/10.1007/s00330-018-5644-3*

15. Pesapane F, Codari M, Sardanelli F. Artificial intelligence in medical imaging: threat or opportunity? Radiologists again at the forefront of innovation in medicine. Eur Radiol Exp. 2018;24:35. *https://doi.org/10.1186/s41747-018-0061-6*

16. Farhadian M, Salemi F, Saati S, Nafisi N. Dental age estimation using the pulp-to-tooth ratio in canines by neural networks. Imaging Sci Dent 2019; 49: 19-26. *https://doi.org/10.5624/isd.2019.49.1.19*

17. Sam A, Currie K, Oh H, Flores-Mir C, Lagravére-Vich M. Reliability of different three-dimensional cephalometric landmarks in cone-beam computed tomography: A systematic review. Angle Orthod 2019; 89: 317-32. *https://doi.org/10.2319/042018-302.1*

18. Krishna AB, Tanveer A, Bhagirath PV, Gannepalli A. Role of artificial intelligence in diagnostic oral pathology-a modern approach. J Oral Maxillofac Pathol 2020;24:152-6. *https://doi.org/10.4103/jomfp.JOMFP_215_19*

19. Chan CH, Huang TT, Chen CY, Lee CC, Chan MY, Chung PC. Texture-map-based branch-collaborative network for oral cancer detection. IEEE Trans Biomed Circuits Syst 2019;13:766-80. *https://doi.org/10.1109/TBCAS.2019.2918244*

20. Ahmad P, Alam MK, Aldajani A, Alahmari A, Alanazi A, Stoddart M, Sghaireen MG. Dental Robotics: A Disruptive Technology. Sensors (Basel). 2021;21:3308. *https://doi.org/10.3390/s21103308*

21. Park WJ, Park JB. History and application of artificial neural networks in dentistry. Eur J Dent. 2018;12:594-601. *https://doi.org/10.4103/ejd.ejd_325_18*

22. Mupparapu M, Wu CW, Chen YC. Artificial intelligence, machine learning, neural networks, and deep learning: futuristic concepts for new dental diagnosis. Quintessence Int. 2018;49:687-688.