Evaluation of Knowledge, Attitude, and Practice (KAP) of Artificial Intelligence in Endodontics and Implantology Education: A Cross-sectional Study

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Abstracts

Purpose: The purposes of this study were to assess the knowledge, attitude, and practice (KAP) of AI in Endodontics and implantology education among dental professionals' and dental students in Endodontics and implantology education at the Kingdom of Saudi Arabia. Materials and methods: The present study is a descriptive cross-sectional online survey that was carried out among dental students and dental professionals in the Kingdom of Saudi Arabia. A self-structured, close-ended questionnaire that was administered that consisted of 17 questions was included. The questionnaire validity and reliability were evaluated for vetting and remarks. The questions were circulated through Google Forms, and it was circulated among the study participants through online mode. The data were collected systematically, and SPSS Statistics version 26.0 was used for data analysis. Results: There were 805 responses, (443 dental students and 362 dental professionals') participated in the study through Google Forms. Among these, 435 (54%) were females and 370 (46%) were males. In the study group, 491 (61.0%) were aware of AI, and 314 (39.0 %) were not aware (p-value 0.000). Among the 17 questions used to assess the KAP, 12 questions were significant with a p-value less than 0.05. More than 73 % prefer to use artificial intelligence in endodontics and implantology education. About 120 (14.9%) agreed that AI will replace the role of dentists in the future. There were no significant results in comparing dental students and dental professionals. Conclusion: The current study contributes valuable insights into knowledge, attitudes, and perceptions related to artificial intelligence among dental student and professionals in the Kingdom of Saudi Arabia. Despite some reservations, the majority show a positive view towards the role of AI in the endodontic education, which indicates fertile ground for further exploration and integration of AI technologies into endodontic education. There is a need for continued future research to explore

strategies to improve the potential of AI while test their reliability and relevance in endodontic and implantology education.

Keywords: AI, endodontics, education, knowledge, attitude, practice, implantology.

1. Introduction

In the middle of the 12 Th century, artificial intelligence (AI) research witnessed great progress, and the science of machine control developed, taking advantage of the progress achieved at the level of digital computers, where attempts and experiments were numerous until artificial intelligence became used on a broader scale, including medical diagnosis, data collection, and many other various fields [1]. Artificial intelligence (AI) is known as “the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision making, and translation between languages” [2].

AI has been adopted in many fields of medical and dental imaging diagnostics, precision and digital medicine, decision support, Drug discovery, hospital monitoring, robotic [3]. The importance of artificial intelligence is evident in the ability to employ it in operations, especially in distance learning, as is the case in other educational courses in the field of health care. Employing artificial intelligence in the educational process is essential for developing professional competencies, as it contributes to understanding and interpreting the new world using technologies in a critical, ethical, socially responsible and sustainable manner [1,4].

Endodontics is a branch of dentistry that specializes in diagnosing and treating diseases of the internal tissues of the teeth surrounding the roots [5]. Employing and integrating artificial intelligence in endodontic education contributes to the ability to facilitate personalized learning methodologies, analyze clinical data, in addition to conducting endodontic simulation operations, which contributes to bridging the gap between theoretical science and actual application, which contributes to enriching the knowledge of endodontists and developing their skills to confront Challenges associated with dental health [6]. Implantology is a branch of dental surgery consisting of placement of implants in the lower jaw (mandible) and/or upper jaw (maxillary bone).[19]

A recent study by Thurzo et al. [7] explored developments in the use of artificial intelligence in dental education. Artificial intelligence has the potential to significantly improve the efficiency and effectiveness of dental education. Thus, AI holds promise for the clinical diagnosis and treatment planning of various lesions, offering significant advantages in dentistry [8]. Despite its benefits, AI has yet to be widely adopted in dentistry, resulting in a considerable knowledge gap regarding its applicability in dental clinics and academic settings [9].

The present study aimed to assess the knowledge, attitude, and practice (KAP) of AI in Endodontics education among dental professionals' and dental students.

2. Materials and Methods

Study Design:

This was a cross-sectional study design to assess the knowledge, attitude, and practice (KAP) of AI in Endodontics education among dental professionals' and dental students in Endodontics education at the Kingdom of Saudi Arabia.

Study participants and Sample size:

The researcher used a census sample consisting of all dental professionals' and dental students, which is anticipated to give a correct population indicator and a more incredible consultant pattern without sampling errors. The study excluded non-practicing professionals. The sample size was calculated using OpenEpi.com with an error of 5% and 95% CI. The estimated sample size was 723 participants. In addition, we added 10% to compensate for non-responders; the final sample size was 805 participants.

Questionnaire

A web-based questionnaire was the primary research instrument. The instrument was adapted from a previous study and modified to suit the objectives of this study [10]. The previous study focused on the KAP regarding the AI among dental students and dental surgeons [10]. The questionnaire comprised four sections consisting of 23 questions was framed, where the first included demographic data with four items. The remaining 17 questions were used to assess the knowledge, attitude, and practices, each with 7, 5, and 5 items, respectively. Literature review was the primary source of secondary data since the researcher compared the primary data findings with those of previous scholars on a similar topic. The final questionnaire underwent a face validity assessment to ensure the effectiveness of the questions in aligning with the study's objectives. This assessment utilized the scale-level content validity index based on the average method (S-CVI/Ave), and the resulting average index was calculated to be 0.88, indicating strong content validity [11]. Furthermore, the questionnaire underwent a thorough review and received approval from the Faculty of Dentistry, King Abdulaziz University.

Data Collection:

Data will be collected through structured questionnaires distributed electronically to participants From December 2023 to January 2024.

Data Analysis:

Statistical analysis was carried out using the Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA), version 26. Frequencies and percentages were obtained for the categorical variables, while mean and standard deviation (SD) were calculated for the scale variables. The chi-square test was used to assess the association between the categorical variables and the outcome. A p-value less than 0.05 was considered significant.

3. Result

3.1 Demographics of the participants

A total of 805 responses from dental students and dental professionals were collected. The study group falls within the age group of 18-60 years. About 612 (76%) were within the age group of 18-25 years. Among the study groups, 435 (54%) were females and 370 (46%) were males. About 443 (55%) dental students and 362 (45%) dental professionals were included in the study. Among the 362 dental professionals, 25 (6%) were post-graduate students, 236 (53 %) were bachelor's degree, and 101 (23 %) were master's degree, and 66 (6.6%) were post-graduate students.

Table 1.demographic traits of participants (n=805)

Characteristics	Frequency	Percent (%)
Gender		
Male	370	46 %
Female	435	54 %
Age		
18 - 25	612	76 %
26 - 60	193	24 %
Occupational		
dental students	443	55 %
dental professionals'	362	45 %
Educational level		
Postgraduate students	25	6 %
Bachelor's degree	236	53 %
Master's degree	101	23

3.2 knowledge, attitudes, and practices of dentists of endodontists about the use of AI in endodontic education.

Table 2 summarizes the participants' knowledge, attitudes, and practices (KAP) of endodontists about the use of AI in endodontic education. The study revealed several key findings. Four hundred and ninety-one (61.0%) were aware of AI, while the remaining 314 (39%) were not aware of AI with a significant p value of 0.000. About 362 (45%) know the sites that use artificial intelligence, 314 (39%) said no, and 129 (16.0%) answered I don't know (p value 0.001). Of the endodontists can use artificial intelligence to interpret photographs and analyze histopathology in diagnosing tooth roots 378 (47.0%) agreed, 225 (28.0%) said no, 202 (25.1) answered I don't know (p value 0.000). About 443 (55.0%) agreed that interpreting the analysis of root measurements and treatment plans is also part of AI, 137 (17%) disagreed, and 225 (28.0%) answered as don’t know (p-value 0.008). Among the practitioners, AI training for medical/dental students was significant (p-value 0.000). 523 (65%) agreed that medical/dental curricula can be modernized using AI. Four hundred and forty-two (54.9%) agreed that using AI at all levels of education will improve quality. Five hundred and twenty-four (65.1%) did not agree that AI will replace the role of dentists, compared to 120 (14.9%) who agreed, and 161 (20.0%) who said

they did not know (p=0.000). Most respondents, 395 (49.0%) think the use of AI in dental/endodontics education can improve the knowledge and skills of endodontists.

Most respondents don't agree that artificial intelligence to improve your knowledge regarding endodontics 410 (50.9%), and 135 (16.8%) answered as don't know (p-value 0.013). Among the professionals', the use of AI in diagnosis, treatment plan and prognosis were significant (p-value 0.000). moreover, the usage of AI for record maintenance, follow-up and clinical management was significant (p-value 0.000). Four hundred and ten (50.9 %) agreed that think that artificial intelligence can be used to interpret endodontic analysis and treatment plans in the endodontics department (p value 0.08).

Table 2. knowledge, attitudes, and practices of dentists of endodontists about the use of AI in endodontic education (n=805)

Characteristics	Responses			P value
	yes	no	Don't know	
Knowledge				
Are you aware of artificial intelligence?	491 (61.0%)	213 (26.5%)	101 (12.5%)	0.000
Do you know the sites that use artificial intelligence?	362 (45.0%)	314 (39.0%)	129 (16.0%)	0.001
Do you think endodontists & implantology can use artificial intelligence to interpret photographs and analyze histopathology in diagnosing tooth roots?	378 (47.0%)	225 (28.0%)	202 (25.1%)	0.000
Do you think that in the field of endodontics, AI-powered procedures can save clinic time, quality of work and number of visits?	423 (52.5%)	121 (15.0%)	261 (32.4%)	0.5
Do you think that interpreting the analysis of root measurements and treatment plans in the endodontics & implantology department is also part of artificial intelligence?	443 (55.0%)	137 (17.0%)	225 (28.0%)	0.008
Do you think AI training should be provided to all medical/dental students?	571 (70.9%)	129 (16.0%)	105 (13.0%)	0.000
Do you think medical/dental curricula can be modernized using AI?	523 (65.0%)	241 (29.9%)	41 (65.0%)	0.000
Attitude				
Do you think that applications of artificial intelligence at all levels of education can improve its quality?	442 (54.9%)	217 (27.0%)	146 (18.1%)	0.10
Do you prefer to use artificial intelligence in endodontics & implantology education?	588 (73.0%)	73 (9.1%)	144 (17.9%)	0.08
Do you think AI can replace the role of dentists/general practitioners?	120 (14.9%)	524 (65.1%)	161 (20.0%)	0.000
Do you think the development of artificial intelligence in dentistry can influence innovation in the future?	344 (42.7%)	201 (25.0%)	260 (32.3%)	0.002
Do you think the use of AI in dental/endodontics education can improve the knowledge and skills of dental professionals?	395 (49.0%)	217 (27.0%)	193 (24.0%)	0.003
Practice				
Have you used artificial intelligence to improve your knowledge regarding dental professionals?	260 (32.3%)	410 (50.9%)	135 (16.8%)	0.13

Have you used AI to bring awareness to practical tasks?	297 (36.9%)	385 (47.8%)	123 (15.3%)	0.008
As a practitioner, do you use AI in diagnosis, treatment plan and prognosis?	250 (31.1%)	491 (61.0%)	64 (8.0%)	0.000
As a practitioner, do you use AI for record maintenance, follow-up and clinical management?	382 (47.5%)	201 (25.0%)	222 (27.6%)	0.000
Do you think that artificial intelligence can be used to interpret endodontic analysis and treatment plans in the dental professionals department?	410 (50.9%)	145 (18.0%)	250 (31.1%)	0.08

3.3 comparison between dental professionals' and dental students

Table 3 illustrates the comparison between dental professionals' and dental students, the use of AI was significant (p-value 0.002). Questions regarding the use of artificial intelligence in the field of dentistry can enhance education were significant (p-value 0.000).

Table 3. comparison between dental professionals' and dental students

Characteristics	P value
What AI app do you use?	0.002
Do you think that the use of artificial intelligence in the field of dentistry/endodontics can enhance dental education?	0.000

4. Discussion

The current landscape shows a significant expansion and applicability of artificial intelligence (AI) in both medical and dental domains. AI has emerged as a valuable tool in supporting dental diagnosis and has seen considerable advancement over the past decade [12]. The use of artificial intelligence applications helps to interpret photographs and analyze histopathology in diagnosing Endodontics and & implantology, and artificial intelligence applications help us discover Endodontics [13] Dentistry is a field of study that requires a high level of accuracy; it is expected that AI and deep learning algorithms will be introduced and provide great assistance un this field.[20] many algorithm can estimates bone age from a hand-wrist radiograph has been approved by the MFDS; however, for thiswe conduct thus study which aims to examine the global trends of deep learning technologies applied to dentistry and to forecast the future of dentistry.. In this study, participants' knowledge, attitudes, and practices of dentists of endodontists about the use of AI in endodontic education was assessed using 17 closed-ended questionnaires.

In our study, we had 805 participants (Postgraduate students, Bachelor's degree, and master's degree), of which 54% were females. Our findings show that 491 (61.0%) were aware of artificial intelligence AI and 362 (45.0%) were used of AI apps, clearly shows good knowledge of medical AI integration among Saudi participants. A study conducted by Baby et al. [14] and Swed et al. [15] showed that more than 80% were aware of AI. Also, findings report that 55.0% of the Study population showed an important acknowledgment of AI use in the endodontics; this percentage is relatively similar and consistent with other studies conducted by Karobari et al. [16], where acknowledged the essential role of AI in the field of endodontics. Understanding the importance and limitations of artificial intelligence in endodontic education is essential. Endodontists should

be aware of what AI can and cannot achieve in this field. Making informed decisions about incorporating AI technologies into their practices requires keeping up with the latest developments and research.

A National Survey Study in South India showed that only a minority (26.9%) of respondents agreed AI can replace the role of dentists/general practitioners [10], and this is consistent with our results, where just (14.9%) agreed, Since most participants consider AI to be an adjunct to endodontists rather than a potential alternative to endodontists, this percentage found in our study is likely due to a misunderstanding of the effects and limitations of AI. In the present study, 588 (73.0%) prefer to use artificial intelligence in endodontics education, which is also clearly consonant with results found in Turkish and UK conducted studies [17, 18]. The wider healthcare field, including endodontics, has been exploring AI's potential to improve diagnosis, treatment plans, patient management, and administrative tasks. The awareness of AI in future dental practices has been influenced by this tendency. The endodontics curriculum needs to be revised to include AI.

In this study, there is not much difference between dental students and dental professionals' regarding the knowledge, attitudes, and practices of AI. This is similar to the study conducted by Kalaimani et al. [10]. Some endodontists may see AI as a tool that can improve the quality of education, diagnose and care for patients, treat patients more effectively, and speed up administrative work. However, others may be concerned about job loss, and potential ethical concerns with the use of artificial intelligence in dentistry.

The main limitation of this paper is that the use of AI is not integrated into endodontics education, and it is not well suited as a narrative overview for such a rapidly changing subject. Some findings are likely to become quickly outdated as new research and developments are published. Another limitation of this paper is participants were professionals as well as dental students who may have contributed distinct perceptions of AI to the overall study outcomes.

5. Conclusions

In endodontic education, artificial intelligence has shown its ability to enhance the treatment plan, which in turn can lead to an increased success rate of endodontic treatment outcomes. In recent years, artificial intelligence has dramatically transformed dentistry. It is advancing rapidly, with potential applications covering various areas such as diagnosis, prognosis and treatment prediction. Artificial intelligence is widely used in endodontics and can help in clinical applications, such as detecting periarticular diseases, root fractures, and others. Therefore, awareness about AI should be achieved through dental associations, research institutions, and technology companies by promoting discussions and educational resources related to AI. However, before incorporating AI models into endodontic education, it is still important to conduct additional research to test their reliability and relevance in endodontic education.

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