



Attitudes, Perceptions and Knowledge Regarding the Future of Artificial Intelligence in Oral Radiology Among a Group of Dental Students in Turkey: A Survey

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ABSTRACT

Objective: This study investigated knowledge, attitudes, and perceptions regarding the future of artificial intelligence (AI) for radiological diagnosis among a group of Turkish dental students.

Methods: An online survey was conducted consisting of 11 questions using Google Forms and circulated among 4th and 5th grade students at Marmara University, Faculty of Dentistry. The survey consisted of questions regarding participants' recognition of and attitudes toward AI, their opinions on directions of AI development, and their perceptions about the future of AI in oral radiology. IBM SPSS Statistics 25.0 (IBM SPSS, Turkey) program is used for statistical analysis.

Results: The study group consists of 75 4th and 65 5th grades and a total of 140 students. Of the 140 participating dental students, 60% were already familiar with the concept of AI, 92.9% agreed stated that they would like to use a software/program that can be helpful in radiological diagnosis and 37.9 % reported that AI would have a future in Turkey. Among two grades, there was no statistically significant difference of answers to questions regarding the future and role of artificial intelligence in oral radiology ($p>0.05$).

Conclusion: According to the findings of the study, most dental students were aware of AI, AI systems could be used to improve diagnostic accuracy when reading radiographs, and AI has a promising role in radiological diagnosis.

Keywords: Artificial Intelligence, Dental Students Awareness

1. INTRODUCTION

Artificial intelligence (AI) can be defined in simple terms as using computers or machines to perform tasks that normally require humans (1-5). Machine learning, which is a branch of artificial intelligence, can be used to teach machines and computers how to interpret different kinds of data using various algorithms. AI programs have been designed to interpret data from a variety of sources, and AI applications are commonly used in a variety of fields, including engineering, the stock market, and medicine, among others (3-6). Many individuals, including doctors and physicists, are still unfamiliar with artificial intelligence's principles and true promise, as well as its effect on our personal and professional lives. The medical use of AI systems in medicine has grown in importance in recent years, and their potential uses in dentistry often need careful consideration.

The applications of AI programs in dentistry are very interesting and sustainable, especially in radiology (2-9). In recent years, AI applications in dentistry have attracted attention in areas ranging from the diagnosis of caries to the detection of various pathologies, from planning orthodontic treatment of crowded teeth to robotic surgery and dental implant construction (10-13). Especially adaptation with image processing methods has highlighted the studies of dental radiology. Applications such as classification and segmentation of teeth on 2 and 3 dimensional (2D / 3D) radiological images, determination of dental diseases, determination of gingival diseases and evaluation of risk groups, automatic marking of anatomical structures and cephalometric analysis, diagnosis of some diseases such as osteoporosis that can be detected in jaw radiographs are examples of up-to-date studies (5). It has also been reported

in the literature that AI is used in the early screening of oral cancer and cervical lymph node metastasis, as well as in the diagnosis and treatment planning of various orofacial diseases (7,8).

Clinicians and dental students, on the other hand, have differing perspectives on AI's future. While many claim that artificial intelligence can open many doors in the fields of medicine and dentistry and will pave the way toward a bright future, some believe that AI is unstable and will never be able to replace radiologists (8).

In an online survey of 250 dentists in India, an online questionnaire with 15 questions was used to determine awareness, behaviors, and opinions about the future of artificial intelligence in oral radiology. The AI definition is common to 68% of the 250 dentists who took part in the study, and 69% plan to use AI to make dental diagnoses. The authors stated that 51% of the participants believe that the key role of AI would be the analysis of complicated radiographic scans, and 63% agree that artificial intelligence has a future in India. The study found that dentists are well aware of artificial intelligence, that artificial intelligence programs can be used by dentists as an auxiliary method to improve diagnostic sensitivity when interpreting radiographs, and that artificial intelligence has a promising role in radiological diagnosis (3).

There is only one study about this particular subject among dental students in Turkey, thus, the aim of this study on the future of artificial intelligence in oral radiology information among a group of dental students in Turkey, is to assess the attitudes and perceptions.

2. METHODS

The study protocol of this study was approved by Marmara University School of Medicine Non-Interventional Clinical Research Ethics Committee on 05/03/2021 with protocol number 09.2021.258. The research group consists of 140 4th and 5th grade dental students studying at Marmara University Faculty of Dentistry and the participants were subjected to an online questionnaire using Google Forms consisting of 11 questions adapted from the study of Sur et al. (3) related to knowledge, attitudes, and perceptions regarding the future of artificial intelligence (AI) for future radiological diagnosis.

2.1 Statistical Analysis

IBM SPSS Statistics 25.0 (IBM SPSS, Turkey) program is used for statistical analysis. Besides descriptive statistical methods (mean, standard deviation, frequency), in comparison of qualitative data, Chi-Square test was used and significance was assessed at $p < 0.05$ level.

3. RESULTS

The study was conducted on 140 students, 55 (39.3%) male and 85 (60.7%) female, with ages ranging from 20 to 28. The average age of the students is 22.91 ± 1.48 years. 75 (53.6%) of the students are 4th grade, 65 (46.4%) are 5th grade students.

In the study, 84 (60%) of the 140 respondents were already familiar with AI and its software. Despite the fact that 111 dental students (79.3%) agreed that AI has medical uses, only 55 (39.3%) had a basic understanding of how to incorporate AI into their work.

Furthermore, 37 students (26.4%) agreed that AI would speed up the healthcare system, reduce mistakes, and provide a vast quantity of high-quality data in a timely manner without causing emotional or physical exhaustion.

Almost every participant (92.9%) expressed an interest in using applications for radiological diagnosis yet 41.1% of all participants were unsure if AI would make better diagnoses than a human doctor. In our study only 2.1% of participating dentists stated that they would follow the AI's prediction if there is a controversy, while 31.4% were not sure. A total of 114 participants (81.4%) agreed that they would use AI for dental diagnosis and treatment planning and 50% of dental students agreed that the key function of AI is to interpret complicated radiographic scans. Fifty six dental students (40%) were not sure that AI has a future in Turkey, while 91.4% agreed that AI will help dentists in their diagnosis and decision-making (Table 1).

Evaluations of knowledge, attitudes and perception of AI among 4th and 5th grade dental students are shown in Table 2. There was a statistically significant difference for the question "Are you familiar with AI and its applications?" between two grades. The rate of participating to the statement was higher among 5th grade students ($p=0.002$).

Table 1. Evaluations by Gender

		Male	Female	Total	p
Are you familiar with AI and its applications?	Yes	35 (25.0%)	49 (35.0%)	84 (60%)	0.205
	No	8 (5.7%)	7 (5.0%)	15 (10.7%)	
	Not sure	12 (8.6%)	29 (20.7%)	41 (29.3%)	
Do you agree that AI has useful applications in the medical field?	Yes	46 (32.9%)	65 (46.4%)	111 (79.3%)	0.418
	No	2 (1.4%)	2 (1.4%)	4 (2.9%)	
	Not sure	7 (5.0%)	18 (12.9%)	25 (17.9%)	
Do you have any ideas about how AI might be used in dentistry?	Yes	21 (15.0%)	34 (24.3%)	55 (39.3%)	0.908
	No	10 (7.1%)	7 (12.1%)	27 (19.3%)	
	Not sure	24 (17.1%)	34 (24.3%)	58 (41.4%)	
What are the benefits of using AI, in your opinion?	AI has the potential to improve health-care systems while still reducing medical mistakes.	20 (14.3%)	17 (12.1%)	37 (26.4%)	0.142
	In real time, AI can provide large quantities of scientifically appropriate, high-quality results.	6 (4.3%)	10 (7.1%)	16 (11.4%)	
	AI is resistant to both mental and physical fatigue.	3 (2.1%)	3 (2.1%)	6 (4.3%)	
	All of the above	26 (18.6%)	55 (19.3%)	81 (57.9%)	
Would you like to use a software/program that can be helpful in radiological diagnosis?	Yes	48 (34.3%)	82 (58.6%)	130 (92.9%)	0.096
	No	1 (0.7%)	0 (0.0%)	1 (0.7%)	
	Not sure	6 (4.3%)	3 (2.1%)	9 (6.4%)	
Do you think AI's diagnostic capacity is superior to a human doctor's professional knowledge?	Yes	12 (8.6%)	10 (7.1%)	22 (15.7%)	0.020
	No	25 (17.9%)	27 (19.3%)	52 (37.1%)	
	Not sure	18 (12.9%)	48 (34.3%)	66 (41.1%)	
What decision would you make if your medical opinion and AI's differ?	My own opinion	36 (25.7%)	57 (40.7%)	93 (66.4%)	0.618
	AI's opinion	2 (1.4%)	1 (0.7%)	3 (2.1%)	
	Not sure	17 (12.1%)	27 (19.3%)	44 (31.4%)	
Do you agree that you may use AI while making dental diagnosis and treatment planning in the future?	Yes	41 (29.3%)	73 (52.1%)	114 (81.4%)	0.215
	No	2 (1.4%)	1 (0.7%)	3 (2.1%)	
	Not sure	12 (8.6%)	11 (7.9%)	23 (16.4%)	
In which field of dentistry do you think AI will be most useful?	Making a diagnosis	14 (10.0%)	18 (12.9%)	32 (22.9%)	0.220
	Making treatment decisions	5 (3.6%)	7 (5.0%)	12 (8.6%)	
	Direct treatment (including surgical robots)	14 (10.0%)	12 (8.6%)	26 (18.6%)	
	Interpreting complicated radiographic scans	22 (15.7%)	48 (34.3%)	70 (50.0%)	
Do you think AI has a future in dentistry in Turkey?	Yes	18 (12.9%)	35 (25.0%)	53 (37.9%)	0.017
	No	19 (13.6%)	12 (8.6%)	31 (22.1%)	
	Not sure	18 (12.9%)	38 (27.1%)	56 (40.0%)	
Do you think AI will help dentists in diagnosis and decision-making?	Yes	48 (34.3%)	80 (57.1%)	128 (91.4%)	0.248
	No	1 (0.7%)	0 (0.0%)	1 (0.7%)	
	Not sure	6 (4.3%)	5 (3.6%)	11 (7.9%)	

Chi-square test, $p < 0.05$, AI: Artificial Intelligence

Table 2. Evaluations by Grades

		4 th grade	5 th grade	Total	p
Are you familiar with AI and its applications?	Yes	39 (46.4%)	45 (53.6%)	84 (60.0%)	0.002*
	No	5 (33.3%)	10 (66.7%)	15 (10.7%)	
	Not sure	31 (75.6%)	10 (25.4%)	41 (29.3%)	
Do you agree that AI has useful applications in the medical field?	Yes	61 (43.6%)	50 (35.7%)	111 (79.3%)	0.811
	No	2 (1.4%)	2 (1.4)	4 (2.9%)	
	Not sure	12 (8.6%)	13 (9.3%)	25 (17.9%)	
Do you have any ideas about how AI might be used in dentistry?	Yes	29 (20.7%)	26 (18.6%)	55 (39.3%)	0.971
	No	15 (10.7%)	12 (8.6%)	27 (19.3%)	
	Not sure	31 (22.1%)	27 (19.3%)	58 (41.4%)	
What are the benefits of using AI, in your opinion?	AI has the potential to improve health-care systems while still reducing medical mistakes.	19 (13.6%)	18 (12.9%)	37 (26.4%)	0.910
	In real time, AI can provide large quantities of scientifically appropriate, high-quality results.	9 (6.4%)	7 (5.0%)	16 (11.4%)	
	AI is resistant to both mental and physical fatigue.	4 (2.9%)	2 (1.4%)	6 (4.3%)	
	All of the above	43 (30.7%)	38 (27.1%)	81 (57.9%)	
Would you like to use a software/ program that can be helpful in radiological diagnosis?	Yes	69 (49.3%)	61 (43.6%)	130 (92.9%)	0.409
	No	0 (0%)	1 (0.7%)	1 (0.7%)	
	Not sure	6 (4.3%)	3 (2.1%)	9 (6.4%)	
Do you think AI's diagnostic capacity is superior to a human doctor's professional knowledge?	Yes	13 (9.3%)	9 (6.4%)	22 (15.7%)	0.587
	No	25 (17.9%)	27 (19.3%)	52 (37.1%)	
	Not sure	37 (26.4%)	29 (20.7%)	66 (47.1%)	
What decision would you make if your medical opinion and AI's differ?	My own opinion	47 (33.6%)	46 (32.9%)	93 (66.4%)	0.209
	AI's opinion	3 (2.1%)	0 (0%)	3 (2.1%)	
	Not sure	25 (17.9%)	19 (13.6%)	44 (31.4%)	
Do you agree that you may use AI while making dental diagnosis and treatment planning in the future?	Yes	61(43.6%)	53 (37.9%)	114 (81.4%)	0.750
	No	1 (0.7%)	2 (1.4%)	3 (2.1%)	
	Not sure	13 (9.3%)	10 (7.1%)	23(16.4%)	
In which field of dentistry do you think AI will be most useful?	Making a diagnosis	14 (10.0%)	18 (12.9%)	32 (22.9%)	0.069
	Making treatment decisions	3 (2.1%)	9 (6.4%)	12 (8.5%)	
	Direct treatment (including surgical robots)	15 (10.7%)	11 (7.9%)	26 (18.6%)	
	Interpreting complicated radiographic scans	43 (30.7%)	27 (19.3%)	70 (50.0%)	
Do you think AI has a future in dentistry in Turkey?	Yes	31 (22.1%)	22 (15.7 %)	53 (37.9 %)	0.497
	No	14 (10.0%)	17 (12.1%)	31 (22.1%)	
	Not sure	30 (21.4%)	26 (18.6 %)	56 (40.0%)	
Do you think AI will help dentists in diagnosis and decision-making?	Yes	67 (47.9 %)	61 (43.6%)	128 (91.4 %)	0.240
	No	0 (0.0%)	1 (0.7%)	1 (0.7%)	
	Not sure	8 (5.7%)	3 (2.1%)	11 (7.9%)	

Chi-square test, $p < 0.05$, AI: Artificial Intelligence

4. DISCUSSION

The applications of artificial intelligence in dentistry are interesting, especially in radiology, and AI can be a valuable resource for new dentists. Merely, a limited number of studies focused on knowledge, attitudes, and perceptions regarding the future of artificial intelligence for radiological diagnosis among dental students.

Oh et al. (1) centralized into how well-informed Korean doctors are about AI and how they feel about it being used in medicine. They used Google Forms to create an online survey of 11 closed-ended questions. The survey included

questions about AI awareness and behaviors, AI creation in medicine, and the potential dangers of using AI in medicine. The survey was conducted by 669 participants in total. Just 40 doctors (5.9%) claimed that they were very familiar with artificial intelligence. However, the majority of participants thought AI could be helpful in medicine (83.4% agreement). Disease diagnosis is the field of medicine where respondents decided AI will be most helpful (83.4% agreement). Less than half of the participants (43.9%) agreed that AI is diagnostically superior to human doctors. Merely 237 people (35.4%) accepted that AI will eventually replace them in their employment. Higher rates of agreement was reported

in a study conducted in India, where 68% of dentists are familiar with the definition of AI, 69% believe AI can be used in diagnosis and care preparation, and 63% believe AI has a future in India (3).

In a study of dental students' attitudes and expectations of artificial intelligence, a 22-item questionnaire was administered via Google Forms to dental students from all 9 different Turkish dental schools (14). Of the 1103 students who took part in the study, 48.40% had a basic understanding of AI technology, 85.70% believed dentistry would revolutionize AI, and 74.60% and 79.80% felt AI-related topics should be included in undergraduate and graduate dental education, respectively. The participants were found to have inadequate knowledge of AI, but were able to learn more about it and believed that artificial intelligence would have a positive effect on prospective dentistry practices. In our survey, 84 (60%) of the 140 participants had prior knowledge of AI and its applications. While 111 dental students (79.3%) accepted that AI has medical applications, only 55 (39.3%) had a basic understanding of how to integrate AI into their practice. In addition, among two grades, there was no statistically significant difference of answers to questions regarding the future and role of artificial intelligence in oral radiology ($p > 0.05$).

Dental students were given an online Google forms link to complete a self-administered questionnaire based on their knowledge of artificial intelligence's application in medicine in a study by Ranjana *et al.* (15) According to the findings, about 59% of research participants were aware that artificial intelligence technologies in medicine benefits physicians, and both male and female students were similarly aware of artificial intelligence. When the relationship between gender and their opinion on AI as a method for revolutionizing clinical decision and diagnosis was examined, it was discovered that 28 out of 51 females and 29 out of 59 males firmly agree that clinical decision and diagnosis can be revolutionized with the aid of AI. Although statistically not significant, female students had a higher agreement rate (46.4%) that AI has useful applications in the medical field than male students in our study.

5. CONCLUSION

AI is a branch of computer science that can analyze large amounts of medical data. In several clinical scenarios, this technology aids in the diagnosis, treatment, and prediction of outcomes. As all AI technology has the ability to evolve into an advanced tool capable of processing more complex data in dentistry, there needs to be a greater knowledge of the technology in order to better understand and analyze it among future dentists.

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Conflicts of interest

The authors declare that they have no conflict of interest.

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