Received: 7 June 2022 | Revised: 21 December 2022 | Accepted: 17 January 2023

DOI: 10.1002/jdd.13189

ADEA THE VOICE OF DENTAL EDUCATION WILEY

ORIGINAL ARTICLE

Korean dental hygiene students' perceptions and attitudes toward artificial intelligence: An online survey

Hui Jeong[1] | **Sang-Sun Han**[1] | **Ki-Eun Kim**[2] | **Il-Soon Park**[3] | **Youngyuhn Choi**[4] | **Kug Jin Jeon**[1]

[1]Department of Oral and Maxillofacial Radiology, Yonsei University College of Dentistry, Seoul, Korea

[2]Department of Dental Hygiene, Daejeon Institute of Science and Technology, Daejeon, Korea

[3]Department of Dental Hygiene, Kyungdong University, Gangwon-do, Korea

[4]Department of Dental Hygiene, Suwon Science College, Gyeonggi-do, Korea

Correspondence
Kug Jin Jeon, Department of Oral and Maxillofacial Radiology, Yonsei University College of Dentistry, Seoul, Korea.
Email: dentjeon@yuhs.ac

Abstract

Objectives: This study investigated Korean dental hygiene students' perceptions and attitudes toward artificial intelligence (AI) and aimed to identify needs for education to strengthen professional competencies.

Methods: A 24-question online survey was conducted to the dental hygiene students from four Korean schools in 2021. The questionnaire included seven questions on basic characteristics and 17 AI-related questions on the student's attitudes toward AI, the confidence in AI, predictions about AI, and its future prospects. Responses were analyzed according to the frequencies and correlations between the participants' subjective level of knowledge about AI and questions using chi-square test.

Results: Invitations were sent out to 1310 students and 800 (61.1%) participated. Note that 44.2% of participants were interested in AI, and 93.1% accessed AI-related information through the internet. Participants expressed lower confidence in AI's diagnosis (14.8%) and judgment (8.1%) than in those of humans, and 21.9% believed AI would replace their job. The proportions of participants with positive perceptions of the usefulness and the potential for improvement of AI in dentistry were 65.5% and 55.4%, respectively. Participants from schools who had existing AI knowledge expressed higher demands for AI-related content as compared to those who did not ($p < 0.05$).

Conclusion: Although dental hygiene students expressed low level of confidence in AI, they were interested in AI and had positive views of its application and potential for improvement. However, the fact they had little AI-related information from dental hygiene curriculum strongly suggests the need for AI-related lectures in schools to prepare for the future.

KEYWORDS
artificial intelligence, attitude, dental, dental hygienists, education, perception

Hui Jeong and Sang-Sun Han contributed equally as the first authors.

1 | INTRODUCTION

Artificial intelligence (AI) refers to technologies in which machines mimic human intelligence to perform functions such as solving complex problems and making decisions.[1] AI technology has evolved significantly since the advent of the Fourth Industrial Revolution. It has revolutionized many aspects of human life, among which the changes in the medical environment are particularly noteworthy.[2,3] In the medical field, AI models have demonstrated high accuracy in numerous studies that investigated automatic analysis results of AI for diseases using image data,[4] and a substantial number of new studies reported that AI enabled rapid and effective infection control in response to the ongoing coronavirus disease 2019 pandemic. These results have led to heightened expectations for the application of AI in actual clinical practice.[5,6] In the field of dentistry, various studies using AI in dental radiographic images have been carried out: the detection of dental caries,[7] the detection of mesiodens,[8] the classification and segmentation of C-type root canals,[9] the automatic segmentation of anatomical structures,[10] and the diagnosis of lesions.[11]

The AI market is expected to continue to grow in the healthcare sector. The Data·AI Economy Revitalization Plan announced by the South Korean government in 2019 indicated that the government planned to build training data sets consisting of 10,000 disease diagnosis and result images to establish an AI-assisted automatic diagnosis service. Healthcare providers will require the ability to understand and use AI to keep up with advancing technologies. Therefore, experts and students in related fields who will encounter these changes must continue to pay attention to AI and prepare for the future.

Several studies have investigated healthcare providers' perceptions and attitudes toward AI. A study among Korean medical students and physicians[12] and a study among Korean radiological technologists[13] were published in 2019. In 2020, a survey of Turkish dental students was reported.[14] However, no studies have been conducted involving dental hygienists or dental hygiene students.

Dental hygienists, who have an important role in the field of dentistry, develop expertise that meets the needs of an ever-changing society through school education.[15,16] In order to nurture competent dental hygienists who can adapt to the changes of the times, the current status of students must be understood, including their perceptions and attitudes about applications of AI technology in dentistry and expectations for its impact on them. This study aimed to develop a comprehensive questionnaire for all dental providers and serve to enhance professional competencies as this pilot of dental hygiene students' perceptions and attitudes toward AI indicates.

2 | METHODS

2.1 | Study participants

This study was conducted with 1310 students enrolled in four randomly selected schools from all schools offering 3- to 4-year dental hygiene degree programs. This study was conducted in compliance with the research ethics guidelines of the Helsinki Declaration and was approved by the Institutional Review Board of the College of Dentistry, Yonsei University (IRB number: 2-2020-0096). An online questionnaire was created using Google Forms describing the rationale, inclusion, and exclusion criteria for the study. Only the dental hygiene students who consented were eligible to complete the survey. The response rate was 61.1% as 800 of the 1310 students participated. Forty-seven participants who answered the questionnaire incorrectly, such as giving multiple responses to a single response questions, were excluded. Finally, the responses of 753 participants were included in this study.

2.2 | Survey and data collection

An online survey containing a total of 24 questions was conducted from September 27, 2021 to October 12, 2021. To develop validated questionnaires for dental providers, four researchers reviewed and modified survey questions originally addressing Korean medical students and physicians,[12] Korean radiological technologists,[13] and Turkish dental students.[14] To check whether the revised questionnaire was compliant with the Checklist for Reporting Results of Internet E-Surveys,[17] a pilot study was completed by 15 students in 4-year dental hygiene degree programs. The reliability of the main survey was indicated by a Cronbach's alpha coefficient of 0.695.

The questionnaire consisted of seven questions on the basic characteristics of participants and 17 AI-related questions. Regarding the basic characteristics, sex, age, place of residence, school year, subjective level of knowledge about AI, sources of the latest dental news and information, and experience in AI development were investigated. The AI-related questions were classified into the following categories: attitudes toward AI (five questions), confidence in AI (three questions), predictions for the application of AI in dentistry (four questions), and prospects for the application of AI (five questions). Seven out of the 17 questions related to AI (questions 8, 12, 13, 20, 22, 23, 24) were answered using a 5-point Likert scale (strongly agree = 5 points, agree = 4, neither agree nor disagree = 3, disagree = 2, strongly disagree = 1 point). Except for those questions and Question 21, the participants were

allowed to respond in their own words if necessary, and multiple responses were allowed for three questions (questions 16, 17, 19).

2.3 | Statistical analysis

A frequency analysis was performed to identify the number of responses and response rates for each question of all participants. A multiple response analysis was performed for multiple response questions (questions 16, 17, 19) to present the case percentage, which is the ratio of the number of participants who selected each item to all participants.

The correlation between participants' subjective level of knowledge about AI (question 5) and their perceptions and attitudes (17 AI-related questions) was assessed using the chi-square test. Responses to the question on subjective level of knowledge about AI were classified into the following three groups: "very much" and "to some extent" were considered "high," "average" was considered "medium," and "little" and "not at all" were considered "low". SPSS version 26 (IBM Corp., Armonk, NY, USA) was utilized in this study, with a significance level of $p < 0.05$.

3 | RESULTS

3.1 | Participants' demographics

Table 1 presents analyses of the basic characteristics of the 753 participants. In total, 96.1% of the participants were female, 85.3% were between 20 and 22 years old. The most common subjective level of knowledge about AI was medium at 51.7%, followed by low at 32.9%, and high at 15.4%. They reported usually receiving the latest medical and dental news and information through the internet (48.3%) and schools or academic societies (44.6%).

TABLE 1 Participants' demographics ($n = 753$)

Question	*n*	%
Q1. What is your sex?		
Male	29	3.9
Female	724	96.1
Q2. How old are you?		
20–22 years	642	85.3
23–25 years	95	12.6
26–28 years	10	1.3
29–30 years	2	0.3
31 years or older	4	0.5
Q3. Which of the following is your main residence?		
Seoul	144	19.1
Capital area	365	48.5
Regional metropolitan area	71	9.4
Local neighborhood	124	16.5
Town or township	49	6.5
Q4. Which year are you in?		
1st	170	22.6
2nd	188	25.0
3rd	236	31.3
4th	159	21.1
Q5. How much do you know about AI?		
High (very much, to some extent)	116	15.4
Medium (average)	389	51.7
Low (little, not at all)	248	32.9
Q6. Where do you usually get the latest medical and dental news and information?		
Schools or academic societies	336	44.6
Internet	364	48.3
Newspapers	14	1.9
Regional metropolitan cities	1	0.1
Books or papers	29	3.9
Acquaintances	8	1.1
Other	1	0.1
Q7. Have you ever been involved in the development of AI?		
Yes, I have	7	0.9
No, I have not.	746	99.1

Abbreviations: AI, artificial intelligence; *n*, number of participants.

3.2 | Questions related to AI

3.2.1 | Attitudes toward AI

The attitudes toward AI using five questions are shown in Table 2. Among all participants, 44.2% were interested in AI used in daily life, and 93.1% answered they obtained information about AI through the internet. On the need for AI-related lectures in dental hygiene curriculum, the highest proportion of participants answered "neither agree nor disagree" (41.2%), while 25.9% answered positively and 32.9% answered negatively.

3.2.2 | Confidence in AI

Table 3 shows the results for the participants' confidence in AI. Only 14.8% answered the diagnostic ability of AI was superior to that of humans, and 8.1% said they would trust the judgment of AI more when dentists and AI disagreed. For misdiagnosis caused by AI, only 0.5% thought that

TABLE 2 Participants' attitudes toward artificial intelligence ($n = 753$)

Question	*n*	%
Q8. Are you interested in AI that is widely used in everyday life?		
Very much, to some extent	333	44.2
Moderately	299	39.7
Rarely, not at all	121	16.1
Q9. How do you mainly learn about AI?		
Schools or academic societies	25	3.3
Internet	701	93.1
Newspapers	12	1.6
Books or papers	3	0.4
Acquaintances	9	1.2
Other	3	0.4
Q10. What is the biggest advantage of AI when applied to dentistry?		
Fast and objective	191	25.4
Integration of vast amount of data	191	25.4
Reduction of misdiagnosis rates	198	26.3
No spatial or temporal constraints	42	5.5
No emotional exhaustion or physical limitations	131	17.4
Other	0	0
Q11. What is the biggest disadvantage of AI when applied to dentistry?		
Difficult to handle unexpected situations other than stored information	224	29.8
Somewhat inflexible to apply to individual patients	253	33.6
Difficult to apply to controversial issues	60	8.0
Decreased ability to consider or empathize with the patient's feelings	190	25.2
Developed by experts with little clinical experience	22	2.9
Other	4	0.5
Q12. Do you think AI-related lectures should be included in the regular curriculum for dental hygiene?		
Strongly agree, agree	195	25.9
Neither agree nor disagree	310	41.2
Disagree, strongly disagree	248	32.9

Abbreviations: AI, artificial intelligence; *n*, number of participants.

the dental hygienist in charge should be held responsible. There were various other answers, such as "everyone listed in the answer choices," "dental institutions and staff," or "the person who put big data in AI", and some argued that no one was responsible.

TABLE 3 The confidence in artificial intelligence according to the participants ($n = 753$)

Question	*n*	%
Q13. Do you think the diagnostic ability of AI is superior to that of experienced dental professionals?		
Strongly agree, agree	111	14.8
Neither agree nor disagree	349	46.3
Disagree, strongly disagree	293	38.9
Q14. Which would you trust more if the dentist's judgment and the AI's judgment are different?		
Dentist's judgment	452	60.0
AI's judgment	61	8.1
Opinions of other experts	140	18.6
Opinions of other AI programs	9	1.2
Leave it to the patient's choice	91	12.1
Q15. Who do you think is liable for misdiagnosis by AI?		
Dentist in charge	221	29.4
Dental hygienist in charge	4	0.5
Company that developed AI	397	52.7
Patient who followed AI's judgment	112	14.9
Other	19	2.5

Abbreviations: AI, artificial intelligence; *n*, number of participants.

3.2.3 | Predictions for the application of AI in dentistry

Table 4 shows the predictions concerning the application of AI in dentistry. The results of the multiple response questions (questions 16, 17, 19) were interpreted based on the case percentage. Most participants predicted that the role of AI in dentistry would be a device to compensate for the limitations of human intellectual ability (53.0%), and AI would be most helpful for the research and development of drugs and materials (45.0%). Some believed that patient management tasks, such as making appointments and conducting customer service, would benefit most from the use of AI.

3.2.4 | Prospects for the application of AI

Table 5 shows the analysis results for AI's prospects in dentistry. A total of 65.5% responded positively to AI's usefulness and 76.3% answered that the commercialization of AI in dentistry would be completed within 4 to 11 years. Furthermore, 55.4% expected that the misdiagnosis rate would decrease due to further improvements in AI in the future. However, when it comes to how

TABLE 4 Participants' predictions about the application of artificial intelligence in dentistry ($n = 753$)

Question	*n*	%	Case %‡
Q16. Which roles do you think AI will play in dental healthcare?			
AI will not be helpful for dental healthcare	42	3.4	5.6
AI will serve as a guide in rare cases	198	16.0	26.3
AI will provide data on evidence-based dental approaches in clinical practice	247	20.0	32.8
AI will be used as a device to compensate for the limitations of human intellectual abilities (neglected by dentists)	399	32.3	53.0
AI will be used as a reference for each treatment	335	27.1	44.5
AI will completely replace dentists' judgment	13	1.1	1.7
Other	1	0.1	0.1
Total	1,235	100.0	164.0
Q17. Which field of dentistry do you think will benefit most from AI?			
Diagnosis	273	22.2	36.3
Treatment decision	140	11.4	18.6
Direct treatment (including surgery)	135	11.0	17.9
Research and development of drugs and materials	339	27.6	45.0
Dental care support in medically vulnerable areas	231	18.8	30.7
Development and improvement of social insurance	108	8.8	14.3
Other	2	0.2	0.3
Total	1,228	100.0	163.1
Q18. Which type of dental healthcare facility do you think AI will be commercialized in first?			
Public primary care institutions such as public healthcare centers	122	16.2	
Primary care institutions such as private clinics	28	3.7	
Specialized clinics (orthodontics, aesthetic prosthetics, joint dental clinic, etc.)	214	28.4	
University hospitals	389	51.7	
Other	0	0	
Q19. Which branch of dentistry do you think AI will be commercialized in first?			
Orthodontics	233	14.3	30.9
Oral medicine	73	4.5	9.7
Oral and maxillofacial Surgery	318	19.5	42.2
Basic dentistry (oral physiology, oral biochemistry, oral and maxillofacial pathology, head and neck anatomy, oral microbiology, dental pharmacology, dental materials science, etc.)	187	11.4	24.8
Endodontics	55	3.4	7.3
Prosthodontics	231	14.1	30.7
Pediatric dentistry	37	2.3	4.9
Oral and maxillofacial radiology	313	19.2	41.6
Preventive dentistry	97	5.9	12.9
Periodontics	43	2.6	5.7
Advanced general dentistry	44	2.7	5.8
Other	1	0.1	0.1
Total	1,632	100.0	216.6

Abbreviations: AI, artificial intelligence; *n*, number of participants.

‡Percentage of participants who selected each item in a multiple-response question.

TABLE 5 Prospects for the application of artificial intelligence according to the participants ($n = 753$)

Question	*n*	%
Q20. Do you expect the application of AI to be useful in dentistry?		
Strongly agree, agree	493	65.5
Neither agree nor disagree	209	27.8
Disagree, strongly disagree	51	6.7
Q21. When do you expect the commercialization of AI in dentistry to take place within the next few years?		
0 to 3 years	36	4.8
4–7 years	293	38.9
8–11 years	282	37.4
12–15 years	81	10.8
16 years or over	61	8.1
Q22. Do you think AI will be further improved in the future to reduce misdiagnosis rates?		
Strongly agree, agree	417	55.4
Neither agree nor disagree	282	37.4
Disagree, strongly disagree	54	7.2
Q23. How often do you expect AI to be used once applied in dentistry?		
It will be used in all practices, will be used in most practices	162	21.5
It will be used in about half the time	256	34.0
It will only be used when absolutely necessary, seldom used	335	44.5
Q24. Do you think AI can replace your job?		
Strongly agree, agree	165	21.9
Neither agree nor disagree	231	30.7
Disagree, strongly disagree	357	47.4

Abbreviations: AI, artificial intelligence; *n*, number of participants.

often AI will be used, 44.5% answered it would be used only when absolutely necessary ($n = 331$) or seldom used ($n = 4$). Regarding the probability of job replacement by AI, 21.9% of participants agreed and 47.4% disagreed.

4 | ANALYSIS ACCORDING TO THE SUBJECTIVE LEVEL OF KNOWLEDGE ABOUT AI

Table 6 presents the seven questions that showed a statistically significant correlation between the participants' subjective level of knowledge about AI (high, medium, and low) and 17 AI-related questions. A total of 41.4% of the high-knowledge group answered "strongly agree" or "agree" regarding the necessity of introducing AI-related lectures into the dental hygiene curriculum, while 18.9% agreed in the low-knowledge group. Approximately three-quarters (75.9%) of participants with high level of knowledge had positive outlook toward the usefulness of AI and its potential for improvement.

5 | DISCUSSION

The development of AI has accelerated along with the Fourth Industrial Revolution, and its importance and necessity have been recognized in the medical field. Given the size of the medical industry, the impact of medical AI on society is expected to increase in the future.[18] AI research and technological development currently underway in the field of dentistry tend to focus on the preclinical stage; however, these technologies are expected to have broad applications in the near future, depending on overall trends. This fact underscores the growing need for education related to this topic in dental-related school programs.[19]

Dental hygienists are dental healthcare professionals who play a crucial role in providing overall care in the field of dentistry. However, since they primarily perform auxiliary tasks, it may be difficult for them to directly use the key functions of AI such as disease detection, classification, and diagnosis, like dentists. Nevertheless, dental hygienists need to be able to understand and use AI in order to prepare for the future changes brought about by AI. As a first step following the trend, this study developed a questionnaire that can be utilized by for dental providers to include the dental hygiene students. We examined the perceptions and attitudes of dental hygiene students toward AI to establish possible connections if any, between their professional development and foundational knowledge within an educational setting.

A total of 753 dental hygiene students participated in this study and, due to the characteristics of their major, most of the participants were female and between 20 and 22 years old. The proportion of participants who self-evaluated as having a high level of knowledge about AI was 15.4%, which was more than twice that reported in a previous study conducted among medical students and physicians published in 2019 (6.0%).[12] This upward trend may reflect the current state of AI, which is no longer an unfamiliar concept in daily life due to rapid developments in AI technology.

Most participants were interested in the various types of AI used in everyday life. The schools/academic societies (44.6%) and the internet (48.3%) had similar response rates for the sources from which participants obtained the latest medical and dental information; however, almost all participants responded using internet (93.1%) to attain AI-related information. Similarly, a study of Turkish

TABLE 6 Analysis results according to the subjective level of knowledge about artificial intelligence

Subjective level of knowledge about AI Questions	*n* (%) High (*n* = 116)	 Medium (*n* = 389)	 Low (*n* = 248)	*p*-Value
Q8. Are you interested in AI that is widely used in everyday life?				
Very much, to some extent	87 (75.0)	193 (49.6)	53 (21.4)	<0.001*
Moderately	23 (19.8)	164 (42.2)	112 (45.2)	
Rarely, not at all	6 (5.2)	32 (8.2)	83 (33.5)	
Q12. Do you think AI-related lectures should be included in the regular curriculum for dental hygiene?				
Strongly agree, agree	48 (41.4)	100 (25.7)	47 (18.9)	<0.001*
Neither agree nor disagree	36 (31.0)	176 (45.2)	98 (39.5)	
Disagree, strongly disagree	32 (27.6)	113 (29.1)	103 (41.6)	
Q17. Which field of dentistry do you think will benefit most from AI?				
Diagnosis	39 (33.6‡)	147 (37.8‡)	87 (35.1‡)	0.038*
Treatment decision	22 (19.0‡)	80 (20.6‡)	38 (15.3‡)	
Direct treatment (including surgery)	28 (24.1‡)	62 (15.9‡)	45 (18.1‡)	
Research and development of drugs and materials	51 (44.0‡)	174 (44.7‡)	114 (46.0‡)	
Dental care support in medically vulnerable areas	41 (35.3‡)	112 (28.8‡)	78 (31.5‡)	
Development and improvement of social insurance	17 (14.7‡)	64 (16.5‡)	27 (10.9‡)	
Other	2 (1.7‡)	0	0	
Total number of response	200	639	389	
Q20. Do you expect the application of AI to be useful in dentistry?				
Strongly agree, agree	88 (75.9)	260 (66.8)	145 (58.5)	0.007*
Neither agree nor disagree	25 (21.5)	106 (27.2)	78 (31.4)	
Disagree, strongly disagree	3 (2.6)	23 (6.0)	25 (10.1)	
Q22. Do you think AI will be further improved in the future to reduce misdiagnosis rates?				
Strongly agree, agree	88 (75.9)	194 (49.9)	135 (54.4)	<0.001*
Neither agree nor disagree	20 (17.2)	172 (44.2)	90 (36.3)	
Disagree, strongly disagree	8 (6.9)	23 (5.9)	23 (9.3)	
Q23. How often do you expect AI to be used once applied in dentistry?				
It will be used in all practices, will be used in most practices	30 (25.9)	83 (21.3)	49 (19.8)	0.033*
It will be used about half the time	44 (37.9)	142 (36.5)	70 (28.2)	
It will only be used when absolutely necessary, seldom used	42 (36.2)	164 (42.2)	129 (52.0)	
Q24. Do you think AI can replace your job?				
Strongly agree, agree	37 (31.9)	75 (19.3)	53 (21.4)	0.033*
Neither agree nor disagree	28 (24.1)	132 (33.9)	71 (28.6)	
Disagree, strongly disagree	51 (44.0)	182 (46.8)	124 (50.0)	

Abbreviations: AI, artificial intelligence; *n*, number of participants.

*$p < 0.05$, chi-square test.

‡Percentage of participants who selected each item in a multiple-response question.

dental students has documented a low response rate indicating a lack of opportunities for dental hygiene students to learn about AI in schools, despite the active research of AI in dentistry.

Participants (14.8%) showed lower confidence in AI's diagnostic and judgment abilities than reported in the previous medical students and physicians (44.0%)[12] and radiological technologists (52.0%)[13] studies. Only 0.5% of the participants said that the dental hygienist in charge should be responsible for misdiagnosis caused by AI, and it can be assumed that the most participants do not believe that dental hygienists are major users of AI or have a high level of responsibility toward the delivery of dental healthcare.

In predicting the application of AI in dentistry, participants believed that AI would enhance the research and development of drugs, development of dental materials, and facilitate the ease of diagnostic decision making. In contrast, the majority of medical students and physicians expected the applications of AI to be limited to clinical settings such as diagnosis and treatment decision.[12] Some participants commented on the possibility of AI easing appointment scheduling and assisting with customer service encounters confirming their expectation that AI could enhance the dental hygienists' daily tasks.

Participants positively predicted the usefulness of AI and its potential for improvement. Of the participants, 76.3% expected the commercialization of AI in the field of dentistry within 4–11 years or in near future as described by Kim et al.[13] However, the response that AI would be used less frequently suggests that participants were aware of the functional limitations of AI and would rely on it selectively as necessary. Both dental hygiene students and dental students disagreed that AI would replace their jobs.[14] This is probably due to the nature of dental work, which involves detail-oriented tasks that are performed on patients in consideration of the individual's oral condition.

A large number of participants did not believe there was a need for AI-related lectures to be incorporated into the dental hygiene curriculum, but participants with a high level of knowledge about AI thought this to be necessary ($p < 0.001$). In a study by Kim et al.,[13] radiological technologists also expressed a strong demand for AI-related classes at universities as a way to prepare for the future. Participants demonstrating a higher-level of AI knowledge valued its potential for improvement as compared to those who did not have a background in AI. This finding is consistent with that of Huisman et al.[20] among radiologists and residents.

This is the first survey study involving dental hygiene students as AI research is advancing within the field of dentistry.

This study is limited to not only dental hygiene students but also in terms of the total number of participants recruited. We developed this comprehensive questionnaire with all the dental providers in mind. In the future, this questionnaire can be reproduced to assess dental students, dental hygiene students, dentists, and dental hygienists' point of views.

6 | CONCLUSION

This study found that dental hygiene students had strong interest in AI and appreciated its application and potential for improvement. Overall, participants expressed a lower level of confidence in AI. Most participants were aware that they received limited AI-related information from their dental hygiene curriculum (3.3%). Participants with high level of knowledge about AI expressed strong interest for AI-related lectures during their training. It is hoped that our research will be used as a foundation to incorporate AI-related information into the future dental hygiene curriculum.

ACKNOWLEDGMENTS

This study was supported by the Yonsei University college of Dentistry Fund (grant number: 6-2021-0012).

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest.

ORCID

Kug Jin Jeon https://orcid.org/0000-0002-5862-2975

REFERENCES

1. Hung K, Montalvao C, Tanaka R, et al. The use and performance of artificial intelligence applications in dental and maxillofacial radiology: a systematic review. *Dentomaxillofac Radiol*. 2020;49(1):20190107.
2. Ooi SKG, Makmur A, Soon AYQ, et al. Attitudes toward artificial intelligence in radiology with learner needs assessment within radiology residency programmes: a national multi-programme survey. *Singapore Med J*. 2021;62(3):126.
3. Ju K, Lee M, Yang H, Ryu D. The 4th industrial revolution and artificial intelligence: an introductory review. *The Journal of Korean Operations Reseach and Management Science Society*. 2017;42(4):1-14.
4. Aggarwal K, Mijwil MM, Al-Mistarehi A-H, et al. Has the future started? The current growth of artificial intelligence, machine learning, and deep learning. *Iraqi Journal For Computer Science and Mathematics*. 2022;3(1):115-23.
5. Vaishya R, Javaid M, Khan IH, Haleem A. Artificial Intelligence (AI) applications for COVID-19 pandemic. *Diabetes Metab Syndr*. 2020;14(4):337-339.
6. Dogan O, Tiwari S, Jabbar MA, Guggari S. A systematic review on AI/ML approaches against COVID-19 outbreak. *Complex Intell Systems*. 2021;7(5):2655-2678
7. Lee J-H, Kim D-H, Jeong S-N, Choi S-H. Detection and diagnosis of dental caries using a deep learning-based convolutional neural network algorithm. *J Dent*. 2018;77:106-111.
8. Ha E-G, Jeon KJ, Kim YH, et al. Automatic detection of mesiodens on panoramic radiographs using artificial intelligence. *Sci Rep*. 2021;11(1):1-8.
9. Sherwood AA, Sherwood AI, Setzer FC, et al. A deep learning approach to segment and classify c-shaped canal morphologies in mandibular second molars using cone-beam computed tomography. *J Endod*. 2021;47(12):1907-1916.
10. Koch TL, Perslev M, Igel C, Brandt SS. Accurate segmentation of dental panoramic radiographs with U-Nets. Paper presented at: 2019 IEEE 16th International Symposium on Biomedical Imaging (ISBI 2019); April 08-11, 2019; Venice, Italy.
11. Lee A, Kim MS, Han S-S, et al. Deep learning neural networks to differentiate Stafne's bone cavity from pathological

radiolucent lesions of the mandible in heterogeneous panoramic radiography. *PLoS One*. 2021;16(7):e0254997.
12. Oh S, Kim JH, Choi SW, et al. Physician confidence in artificial intelligence: an online mobile survey. *J Med Internet Res*. 2019;21(3):e12422.
13. Kim S-H, Hong D-H, Lee J-H, Kim M-H. Measures to expand the role of radiological technologist in expanding the introduction of artificial intelligence. *J.Radiat.Ind*. 2019;13(3):199-206.
14. Yüzbaşıoğlu E. Attitudes and perceptions of dental students towards artificial intelligence. *J Dent Educ*. 2021;85(1):60-68.
15. Lee E-S, Jung J-Y, Ha J-E, et al. Dental hygiene curriculum proposals to improve the ability of dental hygienists as medical professionals. *J Korean Soc Dent Hyg*. 2018;18(6):891-902.
16. Hwang M-Y, Jang G-W, Won B-Y. Relationship between educational satisfaction and learning participation in dental hygiene students. *J Korean Soc Dent Hyg*. 2015;15(6):1091-1097.
17. Eysenbach G. Improving the quality of web surveys: the checklist for reporting results of internet E-surveys (CHERRIES). *J Med Internet Res*. 2004;6(3):e34.
18. Lee SB, Song J, Park A. A trend of artificial intelligence in the healthcare. *Jour. of KoCon.a* 2020;20(5):448-456.
19. Schwendicke Fa, Samek W, Krois J. Artificial intelligence in dentistry: chances and challenges. *J Dent Res*. 2020;99(7):769-774.
20. Huisman M, Ranschaert E, Parker W, et al. An international survey on AI in radiology in 1,041 radiologists and radiology residents part 1: fear of replacement, knowledge, and attitude. *Eur Radiol*. 2021;31(9):7058-7066.

How to cite this article: Jeong H, Han S-S, Kim K-E, Park I-S, Choi Y, Jeon KJ. Korean dental hygiene students' perceptions and attitudes toward artificial intelligence: An online survey. *J Dent Educ*. 2023;87:804–812.
https://doi.org/10.1002/jdd.13189