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Knowledge And Perspective Of Artificial Intelligence In Dentistry Among Dentists And Dental Students: A Cross-Sectional Study

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Abstract

Objective: Artificial Intelligence (AI) is a burning topic and its applications in our daily lives have grown rapidly. Some healthcare workers are concerned about the use of AI, while others hope for improved patient care and greater employment options in the future. The integration of AI will directly impact dental practice. This study evaluated the knowledge and perspective of AI among dental students and dentists at Ziauddin University, Karachi, Pakistan.

Methods: This study was based on a cross-sectional survey. A pre-validated questionnaire was given to every dental student and dentist at Ziauddin University, Karachi. It was divided into several parts to assess the participant's perspectives and knowledge regarding AI and its potential uses in dentistry. The anonymity of the respondent was protected.

Results: 84% of respondents said that they understood what AI is, and 77.2% said they were somewhat familiar with its applications in dentistry. Overall 75.6% of participants agreed or strongly agreed that AI will result in significant advancements in dentistry. On the other hand, 59.2% disagreed or strongly disagreed that AI would ever replace dentists. Dentists scored considerably higher on attitude than dental students, despite no gender-specific differences.

Conclusion: The dental faculty and students at Ziauddin University are generally positive in their perceptions of artificial intelligence in dentistry and have a reasonable awareness of it. However, AI is not used much in reality. Given the global shift to digitalisation, AI must be included in dentistry curricula.

Keywords: Artificial intelligence, Knowledge, Perspective, Dentist

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Introduction

The healthcare sector will witness inventive and groundbreaking advancements worldwide due to enhanced technologies and digitalisation methods.[1] The most recent advancement in these technologies is artificial intelligence. The concept of artificial intelligence was first put forth in 1956 during a workshop by John McCarthy who was working in Dartmouth University as a mathematician and is recognised as the founder of AI. AI is a branch of science and engineering described as one that "is concerned with the computational understanding of what is often referred to as intelligent behaviour and with the production of artefacts that display such behaviour".[2]

AI has shown benefits in dentistry because it functions similarly to the human brain and can accomplish jobs quickly and precisely. Artificial intelligence will cause significant changes in several areas of dentistry.[3] It supports the requirements for evaluating treatment outcomes, therapy planning, and early diagnosis. Radiography aids in our diagnosis by enabling imaging technologies such as CBCT and MRI to detect minute deviations from the norm that the human eye would miss.[4] AI also aids in the planning and diagnosis of orthodontic treatments. Machine learning (ML), is "a branch of study that offers computers the ability to learn without being expressively programmed." Clinical decision-making, including whether or not to do extraction, is aided by machine learning.[5] The accuracy with which AI can predict oral cancer is astounding.

Oral cancer survival rates and quality of life would both increase with early identification. Furthermore, CADCAM technologies are currently used in the production of prostheses, replacing the labour-intensive and time-consuming conventional casting technique and lowering the likelihood of human mistakes in the finished product.[6]

Since AI in dentistry is a very new and developing industry, there are not many studies on the application of AI in this setting. In Serbia, a study revealed a dearth of awareness regarding AI where only 7.9% of respondents were aware of the application of AI, whereas just 34% of respondents thought AI should be employed).[7] Another study conducted in Saudi Arabia reported that 49.1% of participants thought that AI,[8] might eventually replace dentists. A study conducted in Karachi, Pakistan reported that 57.8% of dentists believed it to be advantageous for dental work in the future.[9] Another study conducted in Islamabad reported that only 27.4% of dentists agreed that they were aware of AI.[10] Considering how little has been written about this subject in the literature, the objective of this research was to assess knowledge and perspectives of AI among dentists, and dental undergraduate and postgraduate students of Ziauddin University, Karachi, Pakistan.

Materials And Methods

A self-reported questionnaire and a cross-sectional design were employed in the current study to evaluate the understanding and views of AI among dental students and dentists of Ziauddin University, Karachi. The study participants were recruited using convenience sampling. The objective of the study was to assess dental professionals' and students' knowledge of and attitudes regarding artificial intelligence's application in dentistry, without doing any particular hypothesis testing. As a result, power calculations and sample size calculations were omitted. The survey forms were distributed to the participants after obtaining their verbal and written consent. A questionnaire of around 275 was distributed among which 250 were filled. The invited group had a 90.9% response rate. Inclusion criteria were participants from both genders and dentists, dental undergraduate and postgraduate students of Ziauddin University. An exclusion criterion was non-consented participants. The period of data collection was October 2023–December 2023. A previously validated survey that was used in related studies was modified by the research team.[11, 12] There are 2 main sections in the questionnaire. The first part gathered demographic data related to age, gender and qualification. Section two included 18 statements about knowledge and perception of AI using a Likert scale, where responses range from 1 (strongly disagree) to 5 (strongly agree).

SPSS version 24 was used for data analysis that had been collected. The mean, standard deviation, frequency, and percentages were all incorporated in the descriptive analysis. A t-test was used as an inferential analysis. The significance level was established at a p-value of 0.05. The Ziauddin University research ethics committee granted ethical approval with the following number: 7540823KIOM.

Results

The mean age of participants was calculated to be 24.88 ± 6.13 years. Participants were dental students of all four academic years of Ziauddin University and dentists who were working as faculty members of Ziauddin University. Out of 250 participants, the majority were females 182 (72.8%) and only 68 (27.2%) were males. Among the participants, 56.8% (142) were undergraduate students and 43.2% (108) were dentists. Table 1 provides a detailed presentation of the participant's demographic information.

Table 1. Demographic information of participants

Variable		-	Number of participants	Percentage of participants
Gender		Male	68	27.2%
		Female	182	72.8%
Qualification	Undergraduate dental students	1st year	51	20.4%
		2nd year	22	8.8%
		3rd year	31	12.4%
		4th year	38	15.2%
	Dentists	Postgraduate dental students	13	5.2%
		BDS only	58	23.2%
		BDS with a postgraduate degree	37	14.8%

Of those surveyed, 30.8% strongly agreed that they knew about artificial intelligence, 53.2% of respondents agreed, 8.8% were not sure and 7.2% disagreed. In addition, 77.2% of respondents claimed to understand how artificial intelligence is used in dentistry, 15.6% were not sure 7.2% were unaware of the applications of AI in dentistry and 75.6% of respondents thought that major advancements in dentistry would result from AI.

Table 2 displays the 18 statements that were used to measure participants' knowledge and perspectives toward AI. On all eighteen statements, a t-test showed that there were no statistically significant differences between the genders.

Table 2. Participant's knowledge and perspective towards AI

Statement	Strongly disagree N(%)	Disagree N(%)	Neutral N(%)	Agree N (%)	Strongly agree N(%)	Overall mean (SD)	Dental students mean (SD)	Dentist mean (SD)	p-value
I think AI will lead to major advances in dentistry	10 (4%)	8 (3.2)	41 (16.4%)	119(47.6)	70 (28%)	4.28(4.12)	3.85(1.05)	4.85(6.12)	0.59
Learning AI will open up better job opportunities for dentists	22(8.8)	22(8.8)	50(20)	103(41.2)	53(21.2)	3.57 (1.17)	3.38(1.23)	3.82(1.03)	**0.003**
AI application should be part of postgraduate dental training	11(4.4)	17(6.8)	47(18.8)	119(47.6)	56(22.4)	3.76(1.01)	3.62(1.08)	3.95(0.89)	**0.011**
AI can be used in 3-dimensional implant positioning and planning	11(4.4)	8(3.2)	50(20)	115(46)	66(26.4)	3.86(0.98)	3.76(1.07)	4.00(0.84)	**0.048**
AI can be used for radiographic diagnosis of tooth caries	11(4.4)	14(5.6)	41(16.4)	118(47.2)	66(26.4)	3.85(1.01)	3.78(1.12)	3.94(0.85)	0.231
AI can be used as a quality control tool to assess the success of treatments	9(3.6)	13(5.2)	57(22.8)	108(43.2)	63(25.2)	3.81(0.99)	3.76(1.07)	3.87(0.86)	0.417
AI can be used in the radiographic diagnosis of pathologies in the jaw	14(5.6)	12(4.8)	43(17.2)	124(49.6)	57(22.8)	3.79(1.02)	3.67(1.12)	3.94(0.87)	**0.041**
AI should be part of undergraduate dental training	7(2.8)	15(6.0)	48(19.2)	112(44.8)	68(27.2)	3.87(0.97)	3.78(1.03)	4(0.86)	0.078
AI can be used in the radiographic diagnosis of periodontal diseases	13(5.2)	17(6.8)	46(18.4)	122(48.8)	52(20.8)	3.73(1.03)	3.61(1.10)	3.87(0.90)	**0.048**
AI can be used in the detection of oral cancer in its early stages, such as during health campaigns	11(4.4)	18(7.2)	56(22.4)	118(47.2)	47(18.8)	3.68(1.00)	3.59(1.07)	3.81(0.87)	0.081
AI can be used in forensic dentistry	11(4.4)	13(5.2)	52(20.8)	105(42)	69(27.6)	3.83(1.03)	3.73(1.10)	3.95(0.92)	0.104
AI can be used as a treatment planning tool in dentistry	10(4)	11(4.4)	48(19.2)	118(47.2)	62(24.8)	4.05(3.37)	3.77(1.06)	4.41(4.98)	0.137
AI can be used as a definitive diagnostic tool in the diagnosis of diseases	15(6.0)	28(11.2)	48(19.2)	109(43.6)	50(20)	3.60(1.10)	3.52(1.22	3.70(0.92)	0.215
AI could replace dentists in the future	72(28.8)	76(30.4)	41(16.4)	36(14.4)	25(10)	2.46(1.31)	2.52(1.34)	2.37(1.27)	0.376
AI can provide more accurate digital view of the mouth as compared to other traditional methods	17(6.8)	20(8.0)	73(29.2)	94(37.6)	46(18.4)	3.52(1.09)	3.41(1.17)	3.67(0.95)	0.061
AI secures the patient's personal information and also provides the quick access to its users	18(7.2)	14(5.6)	63(25.2)	108(43.2)	47(18.8)	3.60(1.07)	3.44(1.21)	3.82(0.82)	0.006
AI can secure digital environment using artificial intelligence applications and create a healthcare system with all the latest technologies	11(4.4)	14(5.6)	68(27.2)	113(45.2)	44(17.6)	3.66(0.97)	3.54(1.00)	3.80(0.93)	0.040
AI can be used as a prognostic tool to predict the course of a disease and determine whether there is a chance of recovery	18(7.2)	15(6.0)	65(26)	114(45.6)	38(15.2)	3.55(1.05)	3.43(1.13)	3.71(0.91)	0.039

Significant differences were found between dental students and dentists using a t-test on some of the statements listed like "Learning AI will open up better job opportunities for dentists," "AI application should be part of postgraduate dental training," "AI can be used in 3-dimensional implant positioning and planning,"

"AI can be used in the radiographic diagnosis of pathologies in the jaw" and "AI can be used in the radiographic diagnosis of periodontal diseases," where dentists expressed a far higher degree of agreement with the statement than dental students. Furthermore, a t-test revealed that on every statement, dentists scored higher than dental students as illustrated in Table 2.

Discussion

The objective of the research was to evaluate the perception and understanding of dentists and dental students regarding AI in dentistry. Over 80% of the participants said they were aware of AI and over 75% said they understood the fundamentals of AI and how it is used in dentistry. Gender differences did not significantly affect the results, but dentists scored far higher than dental students on AI in dentistry.

Eighty-four per cent of the participants said they understood what AI was and 77.2% said they were aware of its applications in dentistry. Our findings were higher than those of other research carried out in Central (68%),[13] & North India (55.8% to 77.4%),[14] and Turkey (60%).[15] More intriguingly, a survey conducted in Saudi Arabia found that although 90.7% of respondents knew robotics and AI in dentistry, just 7% might recognize the difference between the two.[16] We declare that the approach of the previous study, which included robotics and artificial intelligence, overstated the frequency of awareness. Additionally, because participants were chosen at an international conference, a variety of nationalities were included. As a result, we assert that our finding has greater validity in terms of awareness of AI in dentistry among dental students and dentists. The use of AI is becoming more common in dentistry, and the disparity in awareness and knowledge rates throughout dental institutes of different countries may be caused by variations in their curricula.

According to the findings of our survey, dentists and dental students have favourable opinions towards the application of AI in dentistry. All of the earlier research carried out in Kenya,[17] Central India,[18] and Saudi Arabia,[19] is comparable to this study. As previously reported, our study also revealed that gender was unrelated to any of the attitude items. Indeed, our study and previous research have demonstrated that dentists are eager to find out more about artificial intelligence and its applications in dentistry. For instance, in the current study, 70% and 72% of the respondents believed that AI should be used in dental education for graduate and undergraduate students, respectively. The above figures are comparable to those of a survey conducted in Turkey which found that 74.60% and 79.80% of respondents felt that AI ought to be taught in postgraduate and undergraduate curricula, independently.[20]

According to the current study, 59.2% of those surveyed disagreed or strongly disagreed that AI will eventually substitute dentists. This has been noted in earlier research as a significant concern. [21, 22] The literature has addressed this issue and concluded that might be challenging to fully take the place of medical professionals with AI systems for several causes which include the interactive discussions between patients and medical professionals, trust, assurance, empathy,[23] and ethical concerns about data accessibility and privacy.[24] On the other hand, it has also been suggested that AI-capable and highly skilled technologists may eventually replace doctors.[25] This emphasizes how crucial it is to include AI and its applications in dentistry should be taught as a core subject in dental school since it is not a luxury but rather a necessity for the future.

This research may be among the few that focus on opinions and understanding of AI of dental students and dentists of Karachi. Since the survey was self-reported, the outcomes are not applied to all dental students and practitioners in Karachi, as the data may not be relevant to them all. Subsequent research endeavours may incorporate more intricate inquiries concerning artificial intelligence from a technological perspective, thereby offering a deeper understanding of the actual state of knowledge regarding AI in dentistry. A prospective study to determine the required and accessible educational resources will be carried out to better comprehend the impact of AI on dental practice.

Conclusions

Dental practitioners at Ziauddin University have a moderate awareness of artificial intelligence AI in dentistry, but they also have a high degree of positive views regarding this use of technology. However, to keep up with the anticipated technological improvements in the dentistry field, AI needs to be given more focus in dental education. This can be accomplished by incorporating the subject into undergraduate, graduate, and even ongoing education curricula.

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