Artificial intelligence in Oral Medicine and Radiology: It's Knowledge, Attitude and Perception among Dental Students

Maryam Qanita[1], *Sanna Safi[2], Fatima Arif[3]

[1,3]*House Officer, KMU Institute of Dental Sciences, Kohat*

[2]*Department of Oral Medicine, KMU Institute of Dental Sciences, Kohat*

ABSTRACT

OBJECTIVES: To determine the knowledge, attitude and perception of dental students towards use of AI in oral medicine and radiology.

METHODOLOGY: This cross-sectional study conducted at KMU-IDS, Kohat included 125 dental students using convenience sampling technique. Data was collected using a prevalidated questionnaire. Questionnaire consisted of a series of close ended questions to assess KAP. About 7 questions were knowledge related, 4 questions each, regarding attitude and perception.

Categorical variables were analyzed using frequencies. Modified Likert scale was used. Mean ± SD of scores of knowledge, attitude and perception for each qualification was calculated. Comparison of Mean ± SD of KAP domains among qualification groups was done using Kruskal Wallis test. Percentile scores were checked and categorization was done for each individual. The relationship between KAP domains was checked using Spearman's Rank Correlation Coefficient.

RESULTS: Around 66.4% (n=83) of participant agreed that for detection of oral cancer and diagnosis of mucosal lesions, AI can be employed (p =0.005). Around 72.8% (n=91) suggested that dental practitioners must use AI in their clinical practices (p value= 0.035).

About 51.2% demonstrated excellent knowledge with a percentile score exceeding 75%. All 125 participants (100%) reflected a positive attitude. About 120 participants (96%) indicated a positive perception. A weak positive correlation between attitude and perception of participants was found statistically significant (p value < 0.001).

CONCLUSION: This was first ever study in Pakistan focusing on artificial intelligence in relation to Oral Medicine and Radiology. Most of the Participants had good knowledge, attitude and perception.

KEYWORDS: Knowledge, Attitude, Perception, AI, Oral medicine and radiology

*For Correspondence

Sanna Safi

Assistant Professor & HOD, Department of Oral Medicine, KMU-IDS, Kohat

Email: sannasafi15@gmail.com

INTRODUCTION

AI (Artificial Intelligence) is a discipline of computer science with an aim of developing algorithms and systems that can mimic, expand, and duplicate human intelligence. AI allows machines to carry out tasks that normally need human cognitive capabilities, such as reasoning, learning, problem solving, perception and decision making[1-3]. Oral medicine, occasionally known as stomatology, links medicine and dentistry by treating oral health problems that are not pertaining to teeth, such as salivary gland disorders, oral mucosal diseases, oral manifestations of systemic diseases and orofacial pain[4,5]. Oral medicine focuses on non-surgical, medical management and usually coordinates with other healthcare professionals[6,7]. Oral radiology uses different imaging modalities such as panoramic radiography, cone beam computed tomography (CBCT), and sometimes ultrasound or MRI to analyse bones, teeth, soft tissues, and other oral areas for diagnosis and treatment planning[8]. AI is fastly transforming oral medicine, providing new tools for disease management from diagnosis till treatment planning. For detection of dental caries, oral cancer, periodontal disease, and different oral pathology from radiographic and clinical images, AI has exhibited high accuracy[9,10].

Despite established AI use for cancer and caries detection,

medical and dental students in Peshawar have medium (62%) AI readiness and only 8% are very ready[11]. About 84% dental students of Karachi understand what AI is, and 77% know some dental uses[12]. Dental students in Pakistan want AI to be part of curriculum as they mostly believe (75-86% agreement) that AI can bring significant advances to dentistry[11,12].

Considering the importance of AI in future and its role in oral medicine and oral radiology, dental students should be equipped with the relevant information about AI in oral medicine and oral radiology. For this purpose, an assessment of already existing knowledge, views and perceptions about AI in oral medicine and oral radiology should be known. There are no such studies in our region, which specifically assess the dental professionals in this regard. Therefore, this study was conducted to overcome this lack of data and to increase awareness about AI regarding oral medicine and oral radiology among dental students. The objective of this research was to determine the knowledge, attitude and perception of dental students regarding AI in oral medicine and oral radiology.

METHODOLOGY

This questionnaire based cross-sectional survey was conducted at Khyber Medical University Institute of Dental Sciences (KMU-IDS), Kohat from January till July 2025. This study included dental students of 3rd year BDS, final year BDS, House officers and Postgraduate residents of KMU-IDS. Dental students of 1st and 2nd year BDS were excluded from this study since they have no clinical exposure. Sample size was based on a similar previous study[13]. Using convenience sampling technique, total 125 dental students consented to participate. After approval from Institute Review Board & Bioethics Committee (IRBB) of KMU-IDS (KIDS-IRBB/ECC/24-9/33), a survey was conducted among the dental students to asses their knowledge, attitude and perception (KAP). Questionnaire was distributed in both hard and soft form among 140 participants. Data for the study was collected through a structured, pretested and prevalidated questionnaire[14]. The questionnaire consisted of informed consent section and then the demographic data (age, gender, qualification) section. The questionnaire consisted of a series of close ended questions in order to test the knowledge, attitude, and perception of dental students about role of AI in oral medicine and radiology. There were 7 questions for the assessment of knowledge, 4 questions regarding the attitude and 4 questions concerning perception. Internal consistency of questionnaire turned out to be 0.77 cronbach's alpha in this study. Data collected was analyzed using SPSS version 25. Categorical variables were analyzed in terms of frequencies and percentages. Chi-square test was used for association between categorical variables (responses on every item and qualification). To get mean scores of KAP domains, Likert scale was modified. Modified likert scale[14] modified into scores was used for analysis (strongly disagree=1, disagree=2, niether agree nor disagree =3, agree=4, strongly agree=5). Mean ± SD of scores of KAP for each category (qualification) was taken. Normality of data was checked with Shapiro wilk test. Mean ± SD of KAP among qualification groups was compared using Kruskal Wallis test. To ensure uniformity in score and evaluate the KAP category, percentile score was checked using formula[14]:

% individual score = score obtained by an individual /total obtainable score * 100

Categorization for the Knowledge was: excellent ≥ 75%, good 50-75%, poor 49-25%, very poor less than 25%. For Attitude categorization, it was positive (>50%) or negative (<50%). For Perception, it was good (50%) or bad (50%). To see the relationship between KAP domain scores, Spearman's Rank Correlation Coefficient was used. Value of p was significant at less than 0.05.

RESULTS

Response rate was 89.2%. Mean age of the participants was 24 ± 1.8. Table 1 and Table 2 shows the gender and qualification frequency, respectively.

Assesing knowledge about AI

Around 117 subjects (93.6%) knew the term artificial intelligence (p value =0.86). Only 80 (64%) were familiar about the working principle of AI (p value = 0.724). 100 participants (80%) agreed that in making diagnosis and treatment planning, AI could be used (p=0.5). About 86 participants (68.8%) think that AI could evaluate radiographs (p value = 0.18). While 66.4% (n=83) of participants agreed that for detection of oral cancer and diagnosis of mucosal lesions, AI can be used in (p =0.005/significant). About 80 participants (64%) agreed that one could use AI as a prognostic tool and for determining the course of disease (p value= 0.004/significant). 84 participants (67.2%) think that AI could be used in assessing success of any treatment (p value=0.45) as treatment quality control.

Assessing attitude about AI

About 58.5% (n=91) people agreed that AI could change the present healthcare system into digital world (p value = 0.108) while 78.4 % (n=98) of the participants agreed that undergraduate or postgraduate dental training should incorporate AI as an important part (p value = 0.77). 87.2% (n=109) participants agreed that after acquiring proper knowledge and training, AI can be incorporated into private practice (p value = 0.77), while 72.8% (n=91) suggested that

		Frequency	Percent
Gender	Male	67	53.6
	Female	58	46.4
	Total	125	100.0

Table 1: Gender Frequency

		Frequency	Percent
QUALIFICATION	3rd year BDS	39	31.2
	4th year BDS	32	25.6
	House officer	35	28.0
	Postgraduate	19	15.2
	Total	125	100.0

Table 2: Qualification Frequency

dental practitioners must use AI in their clinical practices (p value= 0.035/significant).

Assessing perception towards AI

About 76.8%(n=96) participants agreed that in forensic dentistry for identification of unknown individuals and pattern analysis, AI can be used (p value = 0.001/significant).

73.6% of participants (n=95) agreed that AI could provide a better access to patient data while safely storing it (p value=0.028/significant) while only 35.2% individuals (n=44) think that when compared to a clinical practitioner AI have a better diagnostic ability (p value= 0.134). About 39.2% (n=49) participants think that AI could replace radiologists or clinicians in coming days(p value=0.23).

Mean scores of responses on KAP

Mean scores for the domains of knowledge, attitude, and perception were analyzed in relation to the participants' gender and qualification. The knowledge domain comprised seven questions, each carrying five points, yielding a maximum possible score of 35 (7 × 5 = 35). The attitude and perception domains each included four questions, also scored at five points per question, resulting in a maximum score of 20 for each domain (4 × 5 = 20).

Statistical analysis revealed no significant differences in knowledge, attitude, or perception scores when compared across qualification groups. Table 4 presents the mean scores and median IQR for each domain according to participants' qualification.

Correletaion of responses with associated variables:

To investigate the relationships among participants' knowledge, attitudes, and perceptions regarding the role of artificial intelligence (AI) in Oral Medicine and Radiology, Spearman's correlation coefficient test was employed. Table 5 represents the correlation of the KAP domains.

A weak positive correlation between attitude and perception of

participants was found statistically significant (p value < 0.001). With a positive attitude, there is a good perception too.

Overview of KAP of participants

Among participants, 64 individuals (51.2%) demonstrated a knowledge percentile score exceeding 75%, placing them in the category of excellent knowledge. Additionally, 61 participants (48.8%) scored between 50% and 75%, indicating good knowledge.

Regarding attitude, all 125 participants (100%) achieved a percentile score above 50%, reflecting a positive attitude towards the subject.

In terms of perception, 120 participants (96%) had percentile scores greater than 50%, indicating a positive perception about AI role in oral medicine and oral radiology, whereas only 5 participants (4%) scored below 50%, suggesting a negative perception toward AI. Figure 1 shows the participants' KAP category.

DISCUSSION

On gender distribution, in this study, there were 53.6% males and 46.4% females. This is contrary to a study in India[15] where 73% of the participants were females and 27% were male participants. This can be attributed to fluctuation in the number of student enrollments in the various institutions or regions with some dental colleges having more female students.

In our paper, 117 subjects (93.6%) were aware of the term artificial intelligence and 80 (64%) subjects were familiar with working principles of artificial intelligence. Comparable findings were noted in the Indian study[14] in which 93.8% of participants were aware of the term AI whereas 73% of participants were familiar with its working principles. According to our research, although a much higher number of participants is aware of the very concept of artificial intelligence, but a smaller number of respondents is aware of the underlying technology. The results indicate that exposure to AI is prevalent, but deeper knowledge is still missing, perhaps due to absence of formal AI education.

On the issue of the perceived role of AI in diagnosis and treatment planning, 80% participants supported this usage. This percentage was, however, more in studies which were reported in India 88.48%[14], Syria 82.8%[16], Turkey 92.9%[17] and Korea 83.4%[15]. On the other hand, study in Saudi Arabia18 (52.5%) was not in agreement to our results. In our study, the belief of participants in the possibility of AI to aid in diagnosis and treatment planning is high. The difference in the findings indicate that the there is a possibility that local healthcare setup, expertise training, and the knowledge of AI devices can contribute to the differences in knowledge.

With regards to the use of AI to diagnose mucosal lesions and

		Knowledge scrore			Attitude score			Perception score	
	n	Mean SD	p value	n	Mean SD	p value	n	Mean SD	p value
Postgraduates	18	24.84 +/-2.99	0.484	18	15.78 +/- 1.90	0.124	18	12.84 +/- 2.26	0.206
House officers	35	26.34 +/- 2.78		35	15.00 +/- 2.20		35	13.91 +/- 2.25	
Students	71	26.57 +/- 3.37		71	15.69 +/- 2.28		71	14.02 +/-2.62	

Table 4: Mean SD and of scores for each domain according to participants' qualification.

Variables Compared	Spearman's r	p-value	Strength of Correlation	Statistical Significance
Knowledge vs. Attitude	0.040	0.657	Very weak positive	Not significant
Knowledge vs. Perception	-0.077	0.395	Very weak negative	Not significant
Attitude vs. Perception	0.384	< 0.001	Weak positive	Significant

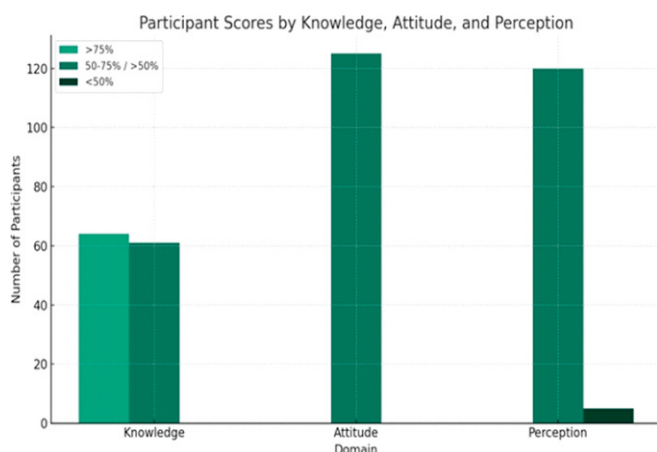Table 5: Spearman's Correlation Coefficients of KAP domains

Figure 1: Frequency of KAP category

detect oral cancer, 83 participants (66.4%) in our research showed their agreement. This was a larger percentage than the ones in Syria[19] (51.6%) and India [20] (57.4%). In our study, the application of AI to detecting mucosal lesions and diagnosing oral cancer has a fairly high amount of backing, which indicates the increasing confidence in the diagnostic capabilities of this technology in the oral health context.

In our study, 64% of respondents acknowledged the possibility of AI as a prognostic method to determine disease progression and recovery. This is in accordance to the studies in which 66.7%[18] and 67.3%[21] of participants supported the potential of AI to predict course of disease and recovery opportunities. These results suggest that a high agreement between participants is based on the AI potential as an effective prognostic instrument in healthcare.

About measuring success of treatments as a quality control measure using AI, 84% participants felt that AI would be useful in the process. Other studies 60.6%[22] and 70.9%[18] are in contrast. Findings of our study indicate that there is the emergence of a pervasive and increasing trust in the capability of AI to track and evaluate therapeutic effects.

Regarding conversion of existing healthcare system into a stable

digital environment, incorporation of AI in dental training and private practice and recommendation of AI use to fellow practitioners, 58.5%, 78.4%, 87.2% and 72.8% of participants agreed to the above statements, respectively. In analogical research[14], the higher values 72.2%, 84.5%, and 76.5% were reported, except for private practice question (85.6%). This study findings indicate that there is a agreement between the respondents regarding the usefulness of adopting AI in dental training, private practice and clinical practice, specifically in the field of diagnosis and treatment planning.

In current study, whether AI can be employed in forensic dentistry, 76.8% of the participants agreed. Similar study had a response rate of 67.6%[21]. It demonstrates the increasing confidence in the applicability of AI in the context of forensics in our study. This is line with 73.6% participants of this study agreeing that AI would support storage of patient data with fast and precise retrieval.

About AI having a higher diagnosis capability than an experienced practitioner, 35.2% of the participants agreed. The response rate was 43.9%[15,23] in the similar studies. The response rate indicates the persistence of skepticism or the opinion that clinical experience remains to play an important role in the diagnostic decision making process.

Concerning the possibility of AI substituting clinicians and radiologists, 39.2% participants agreed. Other studies showed similar response rates of 35.2%[19] and 35.4%[22]. Our results indicate that a considerable number of participants think that AI has potential to substitute the clinicians and radiologists.

Limitations: This was a single center study. A multi-center study involving dental students of various institutes can gather more information about this research topic. Future research is needed to include larger and more diverse samples in various educational establishments. The use of closed ended questions might have limited the capability of respondents to bring out subtle opinions, which could have lead to misinterpretation.

CONCLUSION

This was first ever study in Pakistan focusing on artificial intelligence in relation to Oral Medicine and Oral Radiology. Participants had good knowledge and good perception regarding AI in Oral Medicine and Oral Radiology and had a positive attitude towards it. Nevertheless, this study has shown a number of important deficiencies like lack of deeper understanding of technology and its potential and shortcomings. AI, therefore, should be incorporated in undergraduate and postgraduate curriculum. Multicenter study is recommended to enhance generalizability of study findings.

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AUTHORS CONTRIBUTIONS

MQ: Conception, Design of the work, Data collection, and Drafting, Reviewed, Final approval, Agreement to be accountable

SS: Conception, Design of the work, Acquistion, Data Analysis, and Drafting, Reviewed, Final approval, Agreement to be accountable.

FA: Conception, Design of the work, Interpretation of data for the work, and Drafting, Reviewed, Final approval, Agreement to be accountable.

DATA SHARING POLICY
The data that support the findings of this study are available from the corresponding author upon reasonable request.

ABMS web address: www.abms.kmu.edu.pk
Email address: abms@kmu.edu.pk