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UTILIZATION OF AI TOOLS IN PREDICTING ORAL CANCER RECURRENCE: INSIGHTS FROM ONCOLOGIST AND DENTAL PROFESSIONALS- A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: The integration of artificial intelligence (AI) tools into healthcare has the potential to revolutionize the management of oral cancer, particularly in predicting recurrence. This study explores the current utilization of AI tools by oncology and dental professionals in predicting oral cancer recurrence, focusing on their effectiveness, challenges, and integration into clinical practice. To evaluate the adoption and impact of AI tools in oral cancer recurrence prediction from the perspectives of oncology and dental professionals.

Methods: A cross-sectional survey was conducted using an online questionnaire distributed to oncology and dental professionals. The questionnaire assessed the frequency of AI tool usage, perceived accuracy, encountered challenges, and overall perceptions of these tools. Data were analyzed using descriptive statistics and thematic analysis to identify trends and key insights.

Results: The survey received responses from [N-500] professionals, including [N-100] oncology and [N-400] dental experts. Results indicated that while AI tools are increasingly being integrated into practice, there are significant differences in their utilization and perceived effectiveness between the two groups. Oncology professionals reported higher usage and satisfaction with AI tools compared to dental professionals, who faced more challenges related to training and integration.

Conclusion: AI tools show promise in improving the prediction of oral cancer recurrence, but their adoption varies across different professional groups. The study highlights the need for enhanced training and support to optimize the use of AI tools in clinical settings. Future research should focus on addressing these challenges and further evaluating the impact of AI on patient outcomes.

Keywords: Artificial intelligence, Oral cancer, Recurrence prediction, Oncology, Dental professionals, Clinical practice

INTRODUCTION

Oral cancer is a significant global health concern, accounting for a substantial proportion of cancer-related morbidity and mortality. It encompasses malignancies arising in the oral cavity, including the lips, tongue, cheeks, floor of the mouth, hard palate, and gums. Globally, oral cancer ranks among the most common cancers, particularly in regions with high tobacco and alcohol consumption. Despite advancements in diagnosis and treatment, the prognosis remains poor in many cases due to late-stage detection and limited awareness[1]. The etiology of oral cancer is multifactorial, with tobacco use, excessive alcohol consumption, betel quid chewing, and human papillomavirus (HPV) infection identified as key risk factors. Genetic predisposition, poor oral hygiene, and prolonged exposure to ultraviolet light (in the case of lip cancer) further contribute to its development. Notably, oral cancer is preventable to a large extent, highlighting the importance of early detection, education, and lifestyle modifications in mitigating its burden[2].

Oral cancer remains a significant global health concern, with high rates of morbidity and mortality, especially when not detected or treated in early stages. Despite advancements in treatment modalities, one of the primary challenges remains the recurrence of the disease after initial therapy[3]. Early identification of recurrence is crucial for improving patient outcomes, but conventional diagnostic tools often fall short in providing accurate and timely predictions. In recent years, the advent of artificial intelligence (AI) has introduced new avenues for enhancing diagnostic precision and predictive capabilities in various fields, including oncology and dentistry[4]. AI-driven tools, such as machine learning algorithms, have shown promising potential in predicting disease recurrence by analyzing vast amounts of clinical data, imaging results, and patient-specific factors. By integrating AI into the clinical workflow, healthcare professionals can offer more personalized treatment plans, monitor patients more effectively, and potentially reduce the risk of recurrent cancer[5,6]. This study seeks to explore the perspectives of oncology and dental professionals on the utilization of AI tools in predicting oral cancer recurrence. It aims to provide valuable insights into how AI is being implemented in clinical settings, its perceived benefits, and the challenges faced by professionals in adopting these technologies[7,8]. Understanding these viewpoints is critical for fostering collaboration between dental and oncology fields, as well as for guiding the future development and integration of AI tools in the prediction and management of oral cancer recurrence[9,10].

MATERIALS AND METHODS

This study was designed as a cross-sectional survey to gather insights from oncology and dental professionals regarding the use of artificial intelligence (AI) tools in predicting oral cancer recurrence. The research was conducted through an online questionnaire distributed across various professional networks and institutions in India and Saudi Arabia. Ethical clearance approval was obtained from the institutional review board. The study targeted a diverse group of professionals involved in oral cancer management and diagnosis. Participants were categorized into two groups: Oncology Professionals: Including medical oncologists, radiation oncologists, and surgical oncologists and Dental Professionals: Including general dentists, oral surgeons, and periodontists. A structured questionnaire was developed to capture data on the following aspects which includes Current use of AI tools in predicting oral cancer recurrence, Perceived effectiveness and accuracy of these tools, Challenges and limitations encountered in the use of AI, Training and support provided for using AI tools and Perceptions regarding the integration of AI tools into clinical practice. The questionnaire comprised multiple-choice questions, Likert scale items, and open-ended questions to ensure comprehensive data collection. Pre-testing was conducted with a small group of professionals to validate the instrument's clarity and relevance. The questionnaire was distributed

electronically via email and professional networks. Participants received an invitation letter explaining the study's purpose, the estimated time required to complete the survey, and assurances of confidentiality. Responses were collected over a four-week period. Quantitative data were analysed using descriptive statistics to summarize the prevalence of responses and identify trends. Comparative analysis was performed to examine differences in AI tool usage and perceptions between oncology and dental professionals. Qualitative data from open-ended questions were analysed using thematic analysis to identify common themes and insights. Statistical software SPSS was utilized for quantitative analysis, while qualitative responses were coded and categorized manually to extract relevant themes.

RESULTS

Demographic Characteristics

The study surveyed 500 participants comprising dental practitioners (40%), oncologists (20%), academicians (20%), and those who identified as both dental practitioners and academicians (20%). Most respondents had between 6-15 years of experience, with 34% having 6-10 years and 36% having 11-15 years of experience. Only 8% had 0-5 years of experience, while 22% had 16-20 years. The data for professionals with over 20 years of experience was not available.

Awareness and Knowledge of AI in Predicting Oral Cancer Recurrence

A large proportion of dental practitioners (70%) and oncologists (67%) reported being not familiar with AI tools used in predicting oral cancer recurrence, as did 62% of academicians. Only a small percentage (7.5% of dental practitioners and 19% of oncologists and academicians) indicated they were familiar with these tools. Interestingly, 32% of those who identified as both dental practitioners and academicians reported being familiar with AI tools.

When asked about actual use of AI tools, 75% of dental practitioners and 69% of oncologists reported never having used them, compared to 52% of academicians. However, a greater proportion of the group that identified as both dental practitioners and academicians had used AI tools, with 33% reporting being very familiar.

Attitudes Toward AI in Predicting Oral Cancer Recurrence

Most participants expressed low confidence in the accuracy of AI tools. Specifically, 70% of dental practitioners, 67% of oncologists, and 62% of academicians reported being not confident at all. The combined dental practitioner and academician group showed slightly more confidence, with 32% indicating they were moderately confident.

When asked if AI tools could improve early detection of oral cancer recurrence, there was notable disagreement. Fifty percent of dental practitioners strongly agreed, whereas 60% of oncologists strongly disagreed. The response from academicians was more balanced, with 25% strongly agreeing and 20% strongly disagreeing. The overall difference in responses was statistically significant ($p = 0.021$).

Barriers to Adoption of AI Tools

The primary barrier identified was uncertainty about the accuracy of AI predictions, which was noted by 50% of dental practitioners, 20% of oncologists, and 20% of academicians. Ethical or legal concerns were reported by 40% of oncologists and 60% of those with dual roles as dental practitioners and academicians. The cost of AI tools was a concern for 12.5% of dental practitioners and 20% of academicians. Lack of integration with current practice systems was another barrier for 11.5% of dental practitioners.

Future Perspectives on AI

Regarding the future potential of AI in predicting oral cancer recurrence, opinions varied. Dental practitioners were more optimistic, with 42% believing in the moderate potential of AI, while 39% of oncologists saw only limited potential. Academicians showed higher levels of skepticism, with 62% seeing AI's potential as limited. No group considered AI to have transformational potential.

When asked what additional resources would be necessary to integrate AI into their practice, 26.5% of dental practitioners emphasized the need for training programs, while 64% of academicians preferred peer support and professional networks. The combined dental practitioner and academician group similarly highlighted the need for training (44.5%).

Interest in Further Research and Training

Finally, 60% of dental practitioners expressed interest in further research or training related to AI in dentistry. However, interest was notably lower among oncologists (50%) and academicians (43%). A small percentage of participants, particularly oncologists (40%), were not interested in further involvement.

TABLE 1: ASSESSMENT OF DEMOGRAPHIC DETAILS

QUESTIONAIRRE	OPTIONS	FREQUENCY (N)	PERCENTAGE (%)
1. What is your current level of education/professional status?	**Dental practitioners**	200	40
	Oncologist	100	20
	Academician	100	20
	Dental practitioners + Academician	100	20
2. How many years of experience do you have in the dental field? (Applicable for dental practitioner and academician)	**0-5 years**	16	8
	6-10 years	68	34
	11-15 years	72	36
	16-20 years	44	22
	>20 years		

GRAPH 1: CURRENT LEVEL OF EDUCATON/PROFESSIONAL STATUS

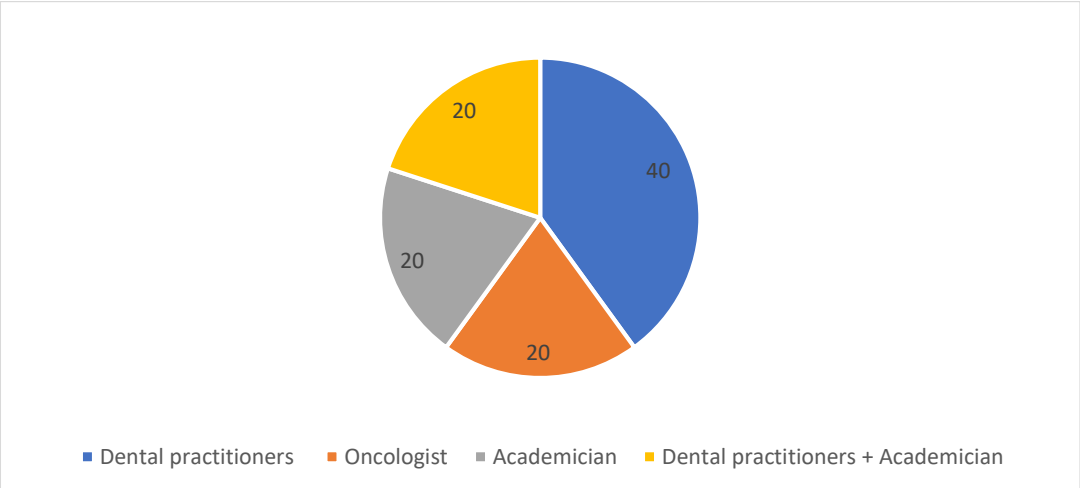

TABLE 2: AWARENESS AND KNOWLEDGE OF AI IN PREDICTING ORAL CANCER RECURRENCE

Questionnaire	**Options**	**Dental practitioners**		**Oncologist**		**Academician**		**Dental practitioners + Academician**		**P-value**
		Frequency (n)	**Percentage (%)**	**Frequency (n)**	**Percentage (%)**	**Frequency (n)**	**Percentage (%)**	**Frequency (n)**	**Percentage (%)**	
How familiar are you with AI tools used in predicting oral cancer recurrence	**Not familiar**	140	70	67	67	62	62	32	32	0.039*
	Somewhat familiar	45	22.5	14	14	19	19	16	16	
	Familiar	15	7.5	19	19	15	15	32	32	
	Very familiar	0	0	0	0	4	4	20	20	
Have you ever used AI tools in your practice for predicting oral cancer recurrence	**Not familiar**	150	75	69	69	52	52	20	20	0.032*
	Somewhat familiar	45	22.5	12	12	19	19	16	16	
	Familiar	5	2.5	14	14	15	15	31	31	
	Very familiar	0	0	5	5	14	14	33	33	
If yes, how frequently do you use AI tools in your practice	**Rarely**	25	12.5	25	25	25	25	25	25	0.12
	Occasionally	25	12.5	20	20	24	24	24	24	
	Frequently	32	16	21	21	25	25	25	25	
	Always	45	22.5	20	20	21	21	21	21	

TABLE 3: ATTITUDES TOWARD AI IN PREDICTING ORAL CANCER RECURRENCE

Questionairre	Options	Dental practitioners		Oncologist		Academician		Dental practitioners + Academician		P-value
		Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	
How confident are you in the accuracy of AI tools for predicting oral cancer recurrence?	Not confident at all	140	70	67	67	62	62	32	32	0.082
	Slightly confident	45	22.5	14	14	19	19	16	16	
	Moderately confident	15	7.5	19	19	15	15	32	32	
	Very confident	0	0	0	0	4	4	20	20	
Do you believe AI tools can improve the early detection of oral cancer recurrence?	Strongly disagree	15	7.5	60	60	20	20	20	20	0.021*
	Disagree	40	20	10	10	15	15	14	14	
	Neutral	20	10	10	10	20	20	14	14	
	Agree	25	12.5	10	10	20	20	15	15	
	Strongly agree	100	50	10	10	25	25	37	37	
How likely are you to recommend	Not likely at all	10	5	50	50	20	20	20	20	0.032*
	Slightly likely	46	23	10	10	15	15	14	14	

the use of AI tools for oral cancer recurrence prediction to your colleagues	**Moderately likely**	10	5	20	20	10	10	15	15	
	Very likely	34	17	10	10	20	20	14	14	
	Extremely likely	100	50	10	10	35	35	37	37	

TABLE 4: BARRIERS TO ADOPTION OF AI TOOLS

Questionairre	**Options**	**Dental practitioners**		**Oncologist**		**Academician**		**Dental practitioners + Academician**		**P-value**
		Frequency (n)	**Percentage (%)**	**Frequency (n)**	**Percentage (%)**	**Frequency (n)**	**Percentage (%)**	**Frequency (n)**	**Percentage (%)**	
What are the primary barriers to using AI tools in predicting oral cancer recurrence in your practice	**Lack of training**	30	15	20	20	10	10	10	10	0.32
	High cost of AI tools	25	12.5	10	10	20	20	10	10	
	Uncertainty about the accuracy of AI predictions	100	50	20	20	20	20	10	10	
	Lack of integration with existing practic	23	11.5	10	10	20	20	10	10	

	e management systems									
	Ethical or legal concerns	22	11	40	40	30	30	60	60	

TABLE 5: FUTURE PERSPECTIVE

Questionairre	**Options**	**Dental practitioners**		**Oncologist**		**Academician**		**Dental practitioners + Academician**		**P-value**
		Frequency (n)	**Percentage (%)**	**Frequency (n)**	**Percentage (%)**	**Frequency (n)**	**Percentage (%)**	**Frequency (n)**	**Percentage (%)**	
What do you believe is the future potential of AI in predicting oral cancer recurrence?	**Limited potential**	72	36	39	39	62	62	54	54	0.067
	Moderate potential	84	42	48	48	31	31	41	41	
	High potential	44	22	13	13	7	7	5	5	
	Transformational potential	0	0	0	0	0	0	0	0	
What additional support or resources would you need to integrate AI tools into your	**Training programs**	53	26.5	7	7	0	0	5	5	0.011*
	Access to affordable AI tools	0	0	0	0	0	0	0	0	
	Improved integration with existing systems	0	0	0	0	0	0	0	0	
	Clearer legal and ethical	0	0	0	0	0	0	0	0	

practice	**guidelines**									
	Peer support and professional networks	58	29	52	52	64	64	64	64	
	All of the above	89	44.5	41	41	36	36	31	31	
Would you be interested in participating in further research or training related to AI in dentistry	Yes	120	60	50	50	43	43	49	49	0.233
	No	17	8.5	40	40	29	29	32	32	
	Not sure	63	36.5	10	10	28	28	29	29	

DISCUSSION

The utilization of artificial intelligence (AI) in predicting oral cancer recurrence is a growing area of interest, particularly as healthcare continues to integrate advanced technology for enhanced patient outcomes[11,12]. This study sheds light on the insights of both oncology and dental professionals regarding the application of AI tools in clinical practice. A key finding from this research is the high level of optimism among professionals about AI's potential to improve early detection and prediction of oral cancer recurrence. AI tools, such as machine learning algorithms, are seen as valuable for processing complex datasets—encompassing clinical histories, imaging results, and genetic profiles—that would be otherwise challenging to analyse using traditional methods. By identifying patterns and predictive markers more efficiently, AI offers the possibility of more precise monitoring of patients, which could lead to earlier interventions and better long-term outcomes[13,14].

However, despite the perceived benefits, several challenges to widespread AI adoption were noted. A significant barrier is the lack of standardized AI tools across clinical practices. Variability in the design and implementation of AI systems may lead to inconsistent results, creating hesitancy among professionals to rely solely on AI for critical decisions regarding recurrence[15,16]. Furthermore, concerns regarding the ethical use of patient data, transparency in AI decision-making processes, and the potential for technology to replace rather than assist healthcare providers were raised. These concerns emphasize the need for a collaborative

approach, where AI complements clinical judgment rather than replacing human expertise. The integration of AI tools in predicting cancer recurrence also requires a multidisciplinary approach. Collaboration between oncologists and dental professionals is vital, as oral cancer management often spans across both specialties[17,18]. AI's ability to bridge this gap could enhance interdisciplinary communication and ensure more comprehensive patient care. Professionals from both fields acknowledged that while AI could offer valuable insights, its success depends on continuous feedback from practitioners, ensuring that these tools align with real-world clinical needs. Moreover, training and education in AI technology were highlighted as critical for successful implementation. Professionals expressed the need for specialized programs that would familiarize them with AI applications, ensuring they are confident in using these tools and interpreting AI-generated predictions. Without adequate training, the full potential of AI may not be realized, and the risk of misinterpretation or over-reliance on technology may increase[19,20].

CONCLUSION

In conclusion, while the utilization of AI in predicting oral cancer recurrence is met with enthusiasm from both oncology and dental professionals, its success relies on addressing existing challenges such as standardization, ethical concerns, and the need for interdisciplinary collaboration. Ensuring that AI tools are developed with input from both fields and supported by adequate training will be crucial in leveraging this technology for improved patient outcomes. As AI continues to evolve, it is likely to become an indispensable tool in oral cancer management, provided that it remains a complement to human expertise rather than a replacement.

AUTHOR'S CONTRIBUTION

Shreya conceived and designed the study, conducted the research and provided the research materials. Wamiq Musheer Fareed collected, organized and interpreted the data. Anupa, Muath and Atyaf wrote the initial and final drafts of the article. Huda and Moayad critically reviewed the manuscript. Lubna performed the data analysis and statistical interpretation and wrote part of the results section. All the authors have critically reviewed approved the final draft and are responsible for the content and similarity index of the manuscript.

CONFLICT OF INTEREST

Nil

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