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"Artificial Intelligence In Diagnosis Of Oral Mucosal Lesions" -Perceptions, Awareness, Among Dental Professionals-A Cross Sectional Questionarre Based Study

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Abstract

Background: Artificial intelligence (AI) is increasingly used in dentistry, particularly for diagnosing oral mucosal lesions, yet awareness among dental professionals remains variable.

Objective: To assess awareness and perceptions of AI in the diagnosis of oral mucosal lesions among dental practitioners.

Methods: A descriptive, questionnaire-based cross-sectional survey was conducted among dental professionals using a pre-validated Google Forms questionnaire. Demographic details and awareness-related responses were collected. Ethical approval was obtained, and participation was voluntary. Data were compiled in Microsoft Excel and analyzed using descriptive statistics (frequencies and percentages).

Results: Most participants demonstrated moderate awareness of AI applications in oral diagnosis, with notable variability in understanding specific functions, benefits, and limitations. While the majority recognized AI's potential to enhance diagnostic accuracy, concerns regarding reliability and dependence persisted.

Conclusion: Dental professionals display positive yet cautious attitudes toward AI. Targeted educational interventions are needed to improve knowledge, confidence, and integration of AI-based diagnostic tools into clinical practice.

Keywords: Artificial intelligence, Oral mucosal lesions, Deep learning, Early diagnosis, Digital pathology

Introduction

Oral mucosal lesions represent a broad spectrum of disorders affecting the lining of the oral cavity, ranging from harmless, self-limiting ulcers to infectious, potentially malignant, and overtly malignant diseases.[1] Traumatic lesions, such as frictional keratosis or traumatic ulcers, typically arise from chronic mechanical irritation caused by sharp teeth, accidental biting, or ill-fitting dentures. Infectious lesions, including those of fungal (e.g., *Candida albicans*), viral (e.g., herpes simplex virus), or bacterial origin, often develop in the presence of systemic illnesses, compromised immunity, prolonged antibiotic use, or poor oral hygiene. Of particular concern are potentially malignant disorders (PMDs) like leukoplakia, erythroplakia, oral submucous fibrosis, and oral lichen planus, which carry a significant risk of malignant transformation if left untreated.[2] The most prevalent malignant lesion of the oral cavity is oral squamous cell carcinoma (OSCC), although other forms such as verrucous carcinoma and lymphomas can also occur. Globally, oral cancer remains one of the most common malignancies, with a disproportionately high burden in South and Southeast Asia.[3] India alone accounts for nearly one-third of global cases, with approximately 144,000 new diagnoses and around 80,000 deaths reported annually, reflecting the severe impact of delayed detection and limited access to early intervention.[4]

Early-stage diagnosis markedly improves survival rates, functional outcomes, and quality of life, underscoring the urgent need for efficient screening and early diagnostic strategies. However, conventional diagnostic approaches such as clinical oral examination (COE) and visual inspection remain subjective and heavily dependent on the clinician's expertise, leading to considerable interobserver variability. Furthermore, confirmatory diagnosis through biopsy and histopathological evaluation, while considered the gold standard, may be delayed due to logistical challenges, limited laboratory facilities, or patient reluctance, particularly in rural and resource-limited settings.[5] Consequently, the overall sensitivity and specificity of conventional examination methods for detecting dysplastic or malignant changes remain moderate, with pooled values of approximately 71% and 85%, respectively. These limitations contribute to missed early cancers, misdiagnosis of benign lesions, and delayed treatment initiation. In this context, the integration of innovative diagnostic technologies particularly artificial intelligence (AI)—offers significant promise in transforming oral healthcare.[6] AI-based systems can analyze clinical and histological images with high precision, support early recognition of suspicious lesions, and assist in triaging patients for timely referral and biopsy.[7] They reduce diagnostic subjectivity, accelerate workflow, and enable more consistent, objective, and reproducible lesion assessment.[8] Beyond improving diagnostic accuracy, AIdriven tools have the potential to expand access to quality oral healthcare in underserved regions through tele-dentistry and community screening initiatives.[9] The Aim of the study is to know awareness regarding artificial intelligence in diagnosis of oral mucosal lesions among dental professionals

Materials and Methods

A descriptive, questionnaire-based survey was conducted to assess the awareness of dental professionals regarding the use of artificial intelligence in diagnosing oral mucosal lesions. A pre-validated, structured questionnaire was designed to collect demographic details and included multiple-choice items to ensure comprehensive data acquisition. The survey was disseminated electronically via Google Forms to facilitate wider and more convenient participation. Ethical approval for the study was obtained from the Institutional Review Board, and the research was carried out under the guidance of the Department of Oral Medicine and Radiology at a private dental college in Chennai. Participants were informed about the study objectives, assured of confidentiality, and their voluntary participation was emphasized in accordance with ethical standards. All responses were systematically compiled using Microsoft Excel, and descriptive statistics primarily frequencies and percentages were used for analysis. The findings were presented in clear tabular and graphical formats to enhance interpretation and visualization.

Results

A total of 104 respondents participated in the survey assessing knowledge and perceptions regarding the use of artificial intelligence in diagnosing oral mucosal lesions. Most participants were general dentists (51.9%), followed closely by postgraduates (48.1%). Clinical experience varied, with the largest proportion having 3–5 years of experience (55.8%), followed by 0–2 years (38.5%). Awareness of AI in dentistry was remarkably high, with 99% reporting they had heard of AI, and radiology emerged as the most recognized field of AI application (59.6%), followed by oral mucosal lesion detection (34.6%). Regarding common oral mucosal lesions, traumatic ulcers (54.8%), lichen planus (43.3%), and leukoplakia (39.4%) were most frequently identified. A strong majority (93.3%) believed AI could help in early diagnosis of oral cancer, and 88.5% felt AI improves diagnostic accuracy for both clinicians and dental students. Approximately 97.1% believed that AI-assisted screening can help reduce mortality rates by enabling timely intervention, while 93.3% agreed that AI can enhance accessibility to oral cancer screening in underserved populations. The primary support required for adopting AI in practice was the need for training workshops (97.1%), with minimal preference for low-cost tools (2.9%). Finally, respondents showed strong willingness to upskill, with 93.3% expressing readiness to participate in AI training programs. Overall, the results indicate high awareness, strong acceptance, and a positive outlook toward integrating AI into oral mucosal lesion diagnosis among dental professionals.

Question	Option	%
1. Professional background	General dentist	51.92%

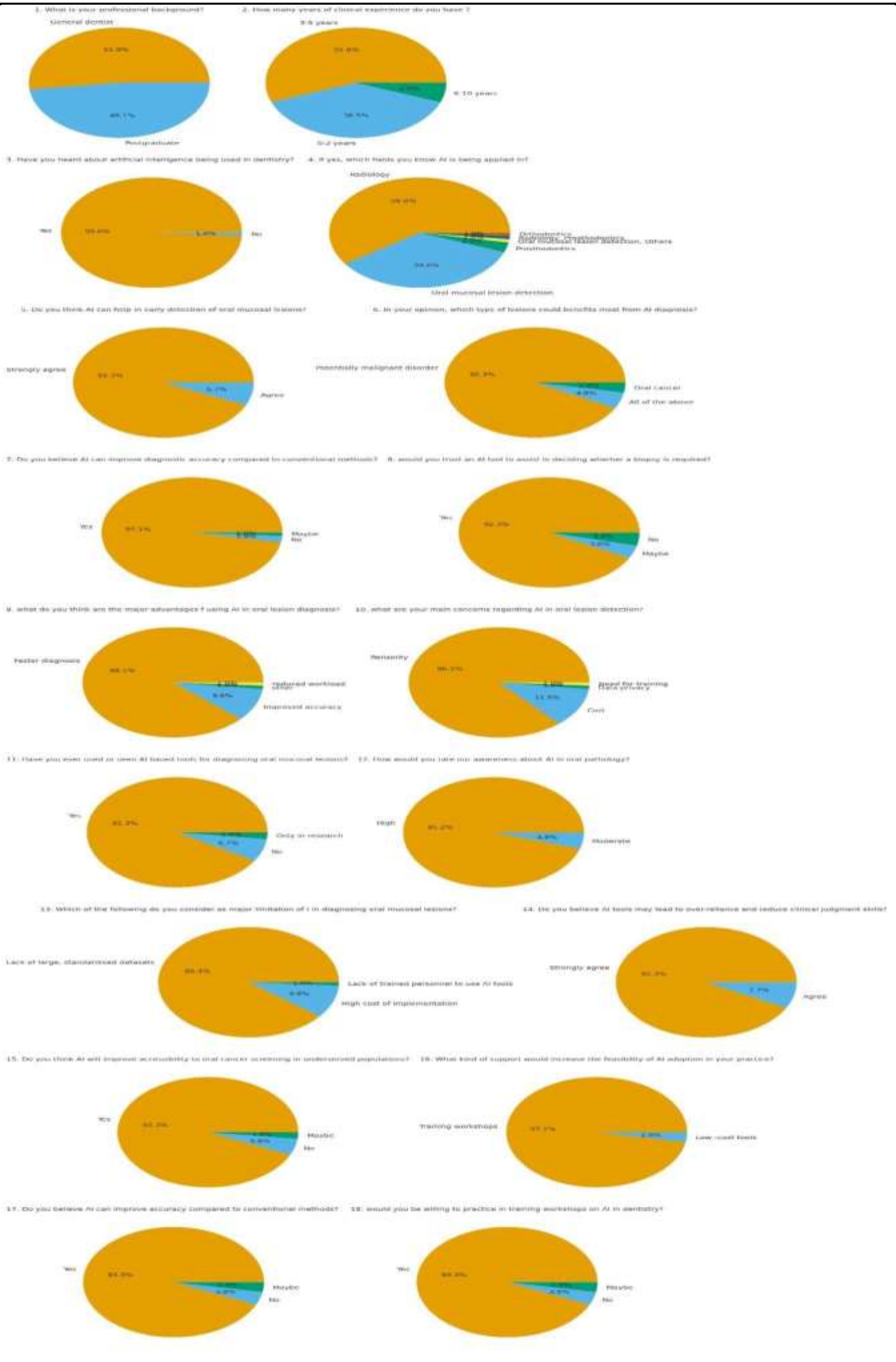
Question	Option	%
	Postgraduate	48.08%
2. Years of clinical experience	3–5 years	55.77%
	0–2 years	38.46%
2. Years of clinical experience	6–10 years	5.77%
3. Heard about AI in dentistry	Yes	99.04%
	No	0.96%
4. Fields where AI is applied	Radiology	59.62%
	Oral mucosal lesion detection	34.62%
	Prosthodontics	2.88%
	Oral mucosal detection + Others	0.96%
	Radiology + Prosthodontics	0.96%
	Orthodontics	0.96%
5. AI helps in early detection	Yes	97.12%
	No	1.92%
	Maybe	0.96%
6. Aware of AI tools	No	59.62%
	Maybe	23.08%

	Yes	17.31%
7. AI easy to use?	Maybe	77.88%
	Yes	17.31%
	No	4.81%
8. Challenges in using AI	Lack of training	82.69%
	High cost	11.54%
	Reliability concerns	5.77%
9. AI reduces subjectivity	Strongly agree	82.69%

Question	**Option**	**%**
	Agree	15.38%
	Neutral	1.92%

10. AI should support not replace	Strongly agree	92.31%
	Agree	7.69%
11. AI improves accessibility	Yes	93.27%
	No	4.81%
	Maybe	1.92%
12. What support needed?	Training workshops	97.12%
	Low-cost tools	2.88%
13. AI improves accuracy	Yes	93.27%
	No	3.85%

	Maybe	2.88%
14. Willing to attend training	Yes	93.27%
	No	3.85%
	Maybe	2.88%


1. What is your professional background?
General dentist
Postgraduate
2. How many years of clinical experience do you have ?
3-5 years
6-10 years
0-2 years
3. Have you heard about artificial intelligence being used in dentistry?
Yes
No
4. If yes, which fields you know AI is being applied in?
Radiology
Oral mucosal lesion detection
Prosthodontics
5. Do you think AI can help in early detection of oral mucosal lesions?
Strongly agree
Agree
6. In your opinion, which type of lesions could benefits most from AI diagnosis?
Potentially malignant disorder
Oral Cancer
All of the above
7. Do you believe AI can improve diagnostic accuracy compared to conventional methods?
Yes
Maybe
No
8. would you trust an AI tool to assist in deciding whether a biopsy is required?
Yes
No
Maybe
9. what do you think are the major advantages f using AI in oral lesion diagnosis?
Faster diagnosis
reduced workload
Improved accuracy
10. what are your main concerns regarding AI in oral lesion detection?
Reliability
Need for training
Cost
11. Have you ever used or seen AI based tools for diagnosing oral mucosal lesions?
Yes
Only in research
No
12. How would you rate our awareness about AI in oral pathology?
High
Moderate
13. Which of the following do you consider as major limitation of i in diagnosing oral mucosal lesions?
Lack of large, standardised datasets
Lack of trained personnel to use AI tools
High cost of implementation
14. Do you believe AI tools may lead to over-reliance and reduce clinical judgment skills?
Strongly agree
Agree
15. Do you think AI will improve accessibility to oral cancer screening in underserved populations?
Yes
Maybe
No
16. What kind of support would increase the feasibility of AI adoption in your practice?
Training workshops
Low-cost tools
17. Do you believe AI can improve accuracy compared to conventional methods?
Yes
Maybe
No
18. would you be willing to practice in training workshops on AI in dentistry?
Yes
Maybe
No

Discussion

The findings of our study align closely with existing literature examining awareness and perceptions of artificial intelligence in dental diagnostics, particularly for oral mucosal lesions. Similar to the survey conducted in Sangli, Maharashtra, where 63.4% of dental practitioners recognized AI as a tool for medical data analysis and 57% believed in its transformative role in clinical decision-making (Adaki et al., 2024), our respondents also demonstrated a generally positive awareness, reflecting an emerging acceptance of AI as a supplementary diagnostic aid.[9] This trend is further supported by a systematic review highlighting that dental professionals worldwide maintain a cautiously optimistic attitude toward AI, acknowledging its capacity to enhance diagnostic accuracy while simultaneously expressing concerns about potential replacement of human roles (Elkhyatt et al., 2025).[10] In terms of diagnostic performance, our results resonate with recent evidence demonstrating the high accuracy of AI-driven tools. For example, ChatGPT-4o achieved an 85% diagnostic accuracy for oral mucosal lesions with outstanding sensitivity (91.7%) and specificity (100%) in prior studies (Vaira et al., 2025)[11], while other machine learning and deep learning models such as CNNbased systems have reported accuracies between 74% and 100%, often matching or outperforming clinician-only assessments (Dubuc et al., 2022).[12] Similarly, Li et al. (2024) documented a sensitivity of 89.9% and specificity of 89.2% for AI-assisted imaging in detecting oral potentially malignant disorders, underscoring the robust diagnostic capability of AI technologies a finding consistent with the diagnostic insights provided by participants in our study.[13] Moreover, the literature emphasizes clinical photography as the most effective mode of AI-based lesion evaluation, reinforcing current diagnostic practices and supporting the use of digital imaging in routine workflows.[14] Nonetheless, concerns such as occasional misclassification especially of malignant lesions highlight the need for continued clinician supervision, a sentiment echoed by respondents in our survey who emphasized that AI should act as a supportive tool rather than an autonomous diagnostic system.[15] Across studies, including ours, there is a shared recognition of significant educational gaps, with growing consensus that structured training programs are essential for optimizing AI integration in dental practice.[16] Thus, while awareness and acceptance of AI are increasing, both the literature and our findings emphasize the importance of enhanced training, improved clinical validation, and responsible integration to ensure AI functions as a powerful adjunct in diagnosing oral mucosal lesions without compromising clinical judgement.[17,18]

Conclusion

Overall, our study demonstrates that dental professionals show a growing awareness and positive outlook toward the use of artificial intelligence in diagnosing oral mucosal lesions, consistent with trends reported in national and international literature. While AI technologies have proven high diagnostic accuracy, sensitivity, and specificity often comparable to expert clinicians there remains a strong consensus that AI should function as a supportive tool rather than replace clinical judgement. The persistent gaps in knowledge and skill highlighted in both our findings and previous studies underscore the need for structured educational programs and hands-on training to enhance confidence, competence, and safe adoption of AI tools in dental practice. Strengthening these competencies will be essential to ensure effective, ethical, and evidence-based integration of AI into oral diagnostic workflows.

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