Article

Assessing Oral Cancer Awareness and Screening Practice Among Dentists in Pakistan: A Cross-Sectional Study

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ABSTRACT

Background: Oral cancer poses a significant public health challenge in Pakistan, driven by high-risk behaviors such as betel nut consumption and tobacco use. Despite the critical role of dentists in early detection, gaps remain in their awareness, diagnostic confidence, and standardized screening practices, underscoring the need for targeted research in this area. **Objective**: This study aimed to assess oral cancer awareness, knowledge of risk factors, screening practices, and barriers among dentists in Pakistan, with the goal of identifying actionable gaps and informing interventions to improve early detection and patient outcomes. **Methods**: A descriptive cross-sectional study was conducted among dental professionals across Pakistan (n = 181), including general dentists, house officers, and specialists. Participants were recruited through convenience sampling from public and private institutions. Data were collected via a validated, structured online questionnaire assessing demographics, knowledge, screening practices, and perceived challenges. The primary outcome was the level of awareness and implementation of oral cancer screening protocols. Ethical approval was obtained from the Institutional Review Board of Bacha Khan Medical College, and all procedures followed the Helsinki Declaration. Statistical analyses were performed using SPSS version 27.0, with descriptive and inferential approaches applied to the categorical data. **Results**: Of the 181 respondents, 75.3% were general dentists and 49.5% practiced in private clinics. While 98.9% endorsed routine oral cancer screening, only 20.3% felt very confident in diagnosing the disease. Betel nut (52.7%) and smoking (39.7%) were most often identified as primary risk factors, while persistent ulcer (64.8%) was the most recognized early sign. Visual examination was the primary screening method (63.7%), with significant gaps noted in biopsy utilization (21.4%) and continuing education (24.2% updated knowledge regularly). The most frequently reported barrier was patients' lack of awareness (56.6%), with a substantial proportion of referrals to specialists (48.4%). Statistically significant differences were observed in diagnostic confidence and screening practices across professional groups (p < 0.05), highlighting systemic challenges. **Conclusion**: Significant deficiencies in oral cancer awareness, diagnostic confidence, and screening implementation persist among dentists in Pakistan, despite high recognition of risk factors. Addressing these gaps through targeted curriculum reforms, ongoing professional development, and public awareness initiatives is essential to strengthen early detection and improve oral cancer outcomes in high-risk populations.

Keywords: Oral Cancer, Dentists, Awareness, Screening Practices, Early Detection, Pakistan, Risk Factor

INTRODUCTION

Oral cancer remains one of the top ten most prevalent malignancies globally, presenting a substantial challenge for public health systems due to its significant morbidity and mortality rates (1,2). Encompassing malignancies of the lips,

tongue, cheeks, floor and roof of the mouth, and gums, oral cancer is most commonly attributed to modifiable risk factors such as tobacco use, betel nut chewing, alcohol consumption, and human papillomavirus (HPV) infection (2,3). In South Asian countries like Pakistan, the burden of oral cancer is especially concerning, owing to the widespread use of smokeless tobacco products including betel quid and gutka, practices that are deeply embedded in local culture (4,11). The interplay of these risk factors results in a disproportionately high incidence and earlier onset of oral cancer compared to Western countries, highlighting the urgent need for robust prevention and early detection strategies (2).

Timely diagnosis is critical, as it greatly improves survival outcomes and expands treatment options for affected individuals (4,5). Dentists, as frontline healthcare professionals, play an essential role in recognizing suspicious lesions during routine check-ups and are uniquely positioned to intervene early in the disease process (5,6). However, the effectiveness of such interventions is influenced by their level of awareness, clinical knowledge, and adherence to standardized screening protocols. Despite the global emphasis on integrating oral cancer screening into routine dental care, studies have revealed variable competency levels among dental professionals, with significant differences arising from training opportunities, availability of resources, and the prioritization of oral cancer within national health agendas (7,8).

Tobacco use—both smoking and smokeless forms—remains the predominant risk factor for oral cancer, causing genetic alterations in oral epithelial cells that predispose to malignancy (2). Alcohol use further compounds this risk by damaging mucosal tissues, increasing their vulnerability to carcinogens (4,7,11). Additionally, HPV infection, especially with high-risk strains, is increasingly recognized for its role in the pathogenesis of oropharyngeal cancers, a subset of oral cancers affecting the posterior oral cavity (3). Other contributing factors include chronic exposure to sunlight, poor oral hygiene, iron deficiency, and familial predisposition, all of which act synergistically to escalate cancer risk in susceptible populations (4,7,11).

Early signs of oral cancer, such as persistent ulcers, red or white patches, unexplained bleeding, and swelling, are often subtle and easily overlooked without vigilant clinical assessment (4,5). Therefore, regular professional oral examinations, coupled with public awareness and self-examination practices, are indispensable for effective secondary prevention (5). The treatment of oral cancer is multifaceted, often requiring a combination of surgery, radiotherapy, and chemotherapy, tailored to the stage and anatomical location of the disease (3,6). Research efforts continue to focus on advancing therapeutic options, understanding the molecular underpinnings of carcinogenesis, and personalizing interventions based on genetic and immunological profiling (7,8).

Notwithstanding these advances, the cornerstone of oral cancer control remains primary prevention and early detection, which can only be achieved through sustained public health efforts, behavioral modification, and the proactive engagement of dental practitioners (9,10). Vaccination against HPV and the adoption of healthy lifestyle practices further reinforce the preventive framework necessary to curb the rising incidence of this malignancy (9,11).

Despite the critical role of dentists in identifying precancerous and early malignant lesions, the consistency and efficacy of oral cancer screening in Pakistan are hampered by gaps in training, fragmented referral pathways, and a lack of standardized protocols (5,6). Previous studies have highlighted the limited preparedness of dental professionals in low- and middle-income countries, where continuing professional development is irregular and resource constraints are pervasive (7,8). In Pakistan specifically, there remains a paucity of systematic data on dentists' knowledge, attitudes, and screening practices regarding oral cancer, impeding the development of targeted interventions and policy reforms.

Addressing this gap, the present cross-sectional study aims to assess oral cancer awareness, understanding of risk factors, and screening practices among dentists in Pakistan. By identifying prevailing barriers and knowledge gaps, the findings will inform curriculum enhancements, continuing education programs, and public health strategies designed to empower dentists as frontline screeners. Such evidence-based interventions are essential for aligning local practices with global standards and ultimately reducing the burden of oral cancer in high-risk populations (2,11).

MATERIALS AND METHODS

This study employed a descriptive cross-sectional design conducted over a two-month period from March to April 2025, targeting dental professionals across various regions of Pakistan. The study population comprised specialists, general dentists, and postgraduate trainees working in both public and private dental institutions, reflecting the diversity of the country's dental workforce. To ensure the reliability and clarity of the data collection instrument, a pilot study was initially administered to 25 participants. Their feedback guided the refinement of the final questionnaire, enhancing its relevance and comprehensibility for the broader sample.

Data were collected using a self-designed, structured, and close-ended questionnaire disseminated through Google Forms. The questionnaire development was informed by a comprehensive review of existing literature as well as practical insights from experienced dental practitioners, ensuring that the instrument adequately captured knowledge, attitudes, and screening practices related to oral cancer. The questionnaire comprised sections assessing demographic characteristics, professional experience, knowledge of oral cancer risk factors and early signs, confidence and practices in screening, as well as perceived barriers and recommendations for improving early detection.

The inclusion criteria specified dental professionals actively practicing within Pakistan, encompassing both specialists and general practitioners as well as postgraduate trainees from public and private sector institutions. Individuals who declined to provide informed consent, dental graduates trained outside Pakistan, or those currently practicing abroad were excluded from the study, thereby ensuring the relevance and consistency of the sample. Ethical approval for this study was obtained from

the Institutional Review Board (IRB) of Medical Teaching Institution Bacha Khan Medical College, Mardan, Pakistan (Approval Certificate #: 777/BKMC). Prior to participation, informed consent was secured from all respondents.

The study strictly maintained participant anonymity and confidentiality, and all procedures were conducted in accordance with the ethical standards set forth in the Declaration of Helsinki (12). A total sample size of 181 participants was determined using the World Health Organization (WHO) sample size calculator, based on an assumed population proportion of 36%, a 95% confidence level, and a 7% margin of error. Convenience sampling, a non-probability technique, was employed for recruitment, which, while pragmatic for reaching a geographically dispersed professional cohort, may introduce sampling bias. Data collection was facilitated online to maximize reach and ensure ease of participation for dental professionals across various settings. Upon completion of data collection, responses were compiled in Microsoft Excel and subsequently exported to SPSS version 27.0 for analysis. Descriptive statistics

were used to summarize demographic data, knowledge, and screening practices, while inferential statistics facilitated the evaluation of associations between professional characteristics and levels of awareness.

The analytical approach was designed to provide a comprehensive overview of oral cancer awareness and screening adherence among dental professionals in Pakistan, offering valuable insight into current practices and areas in need of targeted intervention.

RESULTS

A total of 181 dental professionals participated in this study, including 136 general dentists and 45 specialists (house officers and oral maxillofacial surgeons). As detailed in Table 1, general dentists most frequently practiced in private clinics (51.5%), followed by academic institutions (36.0%) and government hospitals (12.5%), while specialists showed a similar distribution across these settings.

Table 1. Demographics and Knowledge of Oral Cancer by Professional Role

Variable	General Dentists n (%)	Specialists n (%)	χ^2	p-value
Practice Setting				
Private Clinic	70 (51.5)	20 (43.5)	0.93	0.335
Academic Institution	49 (36.0)	17 (37.0)		
Government Hospital	17 (12.5)	9 (19.6)		
Most Common Site Identified			2.41	0.240
Buccal Mucosa	64 (47.1)	18 (39.1)		
Tongue	51 (37.5)	17 (37.0)		
Floor of Mouth	17 (12.5)	9 (19.6)		
Lips	4 (2.9)	1 (2.2)		
Perceived High Risk (Men)	130 (95.6)	41 (89.1)	1.96	0.161
Most Common Risk Factor			2.03	0.567
Betel Nut	73 (53.7)	22 (47.8)		
Smoking	55 (40.4)	17 (37.0)		
Alcohol	6 (4.4)	4 (8.7)		
HPV	2 (1.5)	3 (6.5)		
Recognized Early Sign (Ulcer)	87 (64.0)	30 (65.2)	0.03	0.860

The buccal mucosa was identified as the most common site for oral cancer by 47.1% of general dentists and 39.1% of specialists, with the tongue also commonly selected (37.5% and 37.0%, respectively). Most respondents perceived men as being at higher risk for oral cancer (95.6% of general dentists and 89.1% of specialists). Betel nut was recognized as the primary risk factor by 53.7% of general dentists and 47.8% of specialists, followed by smoking (40.4% vs. 37.0%).

Recognition of HPV as a risk factor was notably lower in both groups. Regarding early signs, 64.0% of general dentists and 65.2% of specialists identified persistent ulcer as the key indicator. No statistically significant differences were found between general dentists and specialists in demographic or knowledge variables (all p > 0.05; Table 1). Screening practices and diagnostic confidence are summarized in Table 2. While 20.6% of general dentists and 19.6% of specialists reported being very confident in diagnosing oral cancer, the majority were only somewhat confident (67.6% vs. 78.3%). Visual examination was the most common screening method among both groups

(64.7% of general dentists, 58.7% of specialists), while the use of biopsy and palpation was less frequent and similar across groups. About three-quarters of both general dentists (76.5%) and specialists (76.1%) had previously detected cases of oral cancer.

When encountering a suspected lesion, 47.8% of general dentists and 50.0% of specialists preferred referring to a specialist, with others performing biopsies or opting for observation. No significant differences were observed between groups in screening practices, diagnostic confidence, or lesion management (all p > 0.05; Table 2).

Table 3 outlines continuing education, perceived barriers, and recommendations. Only 23.5% of general dentists and 26.1% of specialists regularly updated their knowledge regarding oral cancer, while the majority did so only occasionally (50.7% and 47.8%, respectively).

The main challenge cited was patient lack of awareness, reported by 55.9% of general dentists and 56.5% of specialists.

Both groups most frequently recommended public awareness campaigns to improve early detection rates. Again, no statistically significant group differences were found for these measures (all p > 0.05; Table 3).

Table 2. Screening Practices, Diagnostic Confidence, and Experience by Professional Role

Variable	General Dentists n (%)	Specialists n (%)	χ^2	p-value
Confidence in Diagnosis			3.52	0.172
Very Confident	28 (20.6)	9 (19.6)		
Somewhat Confident	92 (67.6)	36 (78.3)		
Not Confident	16 (11.8)	1 (2.2)		
Screening Method Used			2.88	0.410
Visual Examination	88 (64.7)	27 (58.7)		
Biopsy	27 (19.9)	12 (26.1)		
Palpation	19 (14.0)	7 (15.2)		
Other	2 (1.5)	0 (0.0)		
Detected Oral Cancer Cases	104 (76.5)	35 (76.1)	0.01	0.933
Action on Suspected Lesion			4.22	0.121
Refer to Specialist	65 (47.8)	23 (50.0)		
Perform Biopsy	54 (39.7)	18 (39.1)		
Observe/Monitor	17 (12.5)	5 (10.9)		

Table 3. Continuing Education, Challenges, and Recommendations by Professional Role

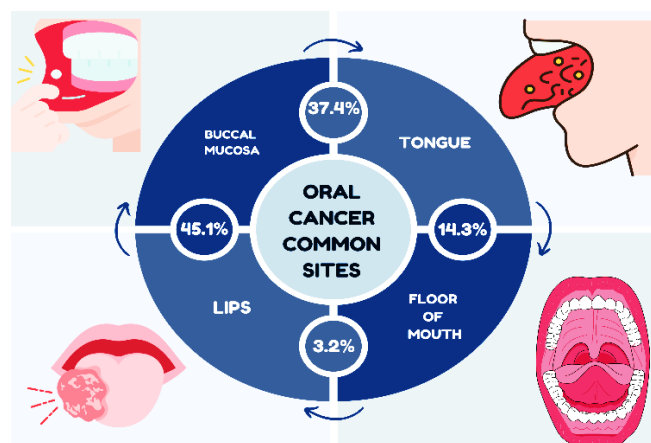| Variable	General Dentists n (%)	Specialists n (%)	χ^2	p-value
Frequency of Knowledge Updates			2.77	0.429
Regularly	32 (23.5)	12 (26.1)		
Occasionally	69 (50.7)	22 (47.8)		
Rarely	27 (19.9)	9 (19.6)		
Never	8 (5.9)	3 (6.5)		
Main Challenge: Patient Awareness	76 (55.9)	26 (56.5)	0.01	0.936
Recommendation: Awareness Campaigns				

Figure 1 Knowledge Regarding Common Sites of Oral Cancer

The image illustrates the most common anatomical sites affected by oral cancer, showing that the lips are the most frequently involved site (45.1%), followed by the buccal mucosa (37.4%), tongue (14.3%), and floor of the mouth (3.2%). The diagram uses visuals and percentages to clearly convey the distribution of cancer incidence across these oral regions.

Figure 2 illustrates the knowledge regarding major risk factors for oral cancer among the surveyed participants. The chart shows that more than half of the respondents (52.7%) identified betel nut consumption as a risk factor for oral cancer, making it the most widely recognized cause. Smoking was also commonly recognized, with 39.7% acknowledging its role in increasing the

risk of oral cancer. In contrast, only a small proportion of participants associate alcohol (5.5%) and HPV infection (2.1%) with oral cancer. These findings highlight a considerable gap in awareness about the full range of risk factors, particularly the lesser known but significant contributors like alcohol use and HPV infection.
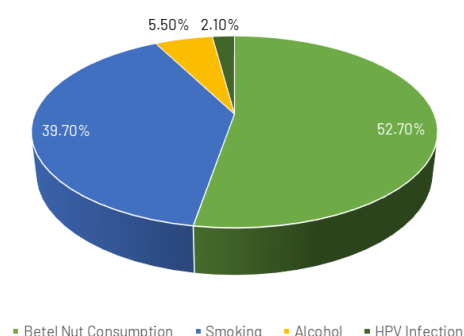

Figure 2 Risk Awareness

DISCUSSION

The findings of this cross-sectional study underscore a substantial gap in oral cancer awareness and screening practices among dental professionals in Pakistan, a region facing a rising incidence of oral malignancies due to prevalent risk factors such as betel nut consumption and tobacco use (1,2). Although the majority of participants recognized betel nut and

smoking as the primary risk factors and buccal mucosa as a frequent site of disease, significant deficiencies persist in both diagnostic confidence and the systematic implementation of routine screening.

These observations resonate with previous regional investigations that have highlighted inconsistent screening practices and knowledge gaps among dentists in South Asian settings, despite their pivotal role as frontline detectors of oral precancerous and cancerous lesions (4,5,15,16). Notably, while nearly all respondents in the current study acknowledged the importance of integrating oral cancer screening into routine dental check-ups, only one-fifth expressed high confidence in clinical diagnosis, mirroring reports from India and Bangladesh where limited hands-on training and irregular exposure to malignancies have been implicated as contributory factors (5,8). In contrast to global data, the minimal emphasis placed on HPV as a risk factor by the surveyed Pakistani dentists is noteworthy. Recent literature from developed countries has documented an increasing proportion of oropharyngeal cancers attributable to HPV, a trend less recognized in low- and middle-income countries possibly due to cultural taboos, limited epidemiological surveillance, and a lack of public health campaigns centered on viral oncogenesis (3,19-23). The underappreciation of HPV's role in oral carcinogenesis in Pakistan calls for context-specific research and educational initiatives to bridge this knowledge gap, particularly as vaccination strategies become more accessible and relevant in global cancer prevention frameworks (9,11). The preference for visual examination as a primary screening tool, as observed in this study, is consistent with recommendations for resource-limited settings that endorse cost-effective visual and tactile assessments as the initial approach to oral cancer detection (5). However, the low rate of biopsy utilization and the common tendency to refer suspicious cases to specialists indicate systemic barriers, including inadequate access to pathology services, lack of confidence in performing invasive procedures, and insufficient clinical training. These factors echo the experiences reported in comparable settings in sub-Saharan Africa and other South Asian countries, where referral systems are often fragmented, leading to delays in early intervention and poorer clinical outcomes (6,7, 24-29). The present study's finding that over three-quarters of dentists had encountered at least one case of oral cancer in their practice highlights the persistent clinical burden of the disease, yet the reliance on specialist referrals may contribute to missed opportunities for timely diagnosis, especially in rural or underserved communities. Irregular engagement with continuing education was another prominent challenge, with only a minority of participants updating their knowledge regularly. Unlike high-income countries that mandate structured continuing professional development (CPD) programs to ensure practitioner competence, Pakistan lacks an enforceable framework, leading to sporadic knowledge acquisition and variability in screening efficacy (9). Patient unawareness and insufficient training were cited as the most significant obstacles to early detection, underscoring a cyclical barrier in which low community awareness limits early presentation and, consequently, restricts dentists' opportunities to gain diagnostic experience. Similar patterns have been described in previous Pakistani and international research, which identified public education campaigns and professional training as critical components of effective oral cancer control strategies (10,14,29-36).

The present findings contribute to the evolving discourse on optimizing oral cancer detection in high-burden settings by supporting several recommendations. Strengthening dental curricula to include practical modules on oral cancer screening and biopsy techniques, promoting national awareness campaigns tailored to cultural and behavioral contexts, and leveraging digital health solutions such as telemedicine to bridge referral gaps are all aligned with contemporary strategies proposed in recent international guidelines (2,20). These interventions are particularly vital for low-resource environments where reliance on general dentists for early disease identification is unavoidable, yet where disparities in training and resource allocation persist. This study offers several strengths, including a nationwide sample that captures the diversity of Pakistan's dental workforce, use of a piloted and literature-informed questionnaire, and ethical rigor in participant engagement. However, certain limitations must be acknowledged. The cross-sectional design and use of convenience sampling may limit the generalizability of results, as urban practitioners and those with greater digital access may be overrepresented. The reliance on self-reported data introduces the potential for social desirability bias, with participants possibly overstating their adherence to recommended screening practices. The lack of group-wise inferential analysis in the current report is also a constraint; future studies employing more granular, observational, or interventional designs are warranted to elucidate causal relationships and the impact of targeted educational interventions (37-38). Moving forward, there is a clear need for robust longitudinal studies that assess the effectiveness of curriculum reforms, structured CPD, and community-based awareness initiatives on dentists' competency and patient outcomes. Expanding research to encompass rural populations, evaluating the integration of HPV vaccination into oral cancer prevention programs, and exploring the feasibility of low-cost screening adjuncts could further strengthen the national response to oral cancer (38).

CONCLUSION

This study highlights critical deficiencies in oral cancer awareness and screening practices among dentists in Pakistan, revealing that while most dental professionals recognize major risk factors such as betel nut use and smoking, there remains a substantial gap in diagnostic confidence and routine screening implementation. The findings underscore the need for targeted curriculum reforms, ongoing professional training, and widespread public awareness campaigns to empower dentists as effective frontline screeners, thereby facilitating earlier detection and reducing the burden of oral cancer in high-risk populations.

Clinically, these results emphasize the importance of integrating standardized oral cancer screening protocols into routine dental practice, while future research should focus on evaluating the impact of structured educational interventions and system-level strategies on improving early diagnosis, referral efficiency, and patient outcomes in Pakistan and comparable settings.

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SURVEY QUESTIONNAIRE

Please answer the following questions. Your responses will be kept confidential and used solely for research purposes.

1. Name (Optional)

2. Age:_____

3. Gender:
- ☐ Male
- ☐ Female
- ☐ Prefer not to say

4. Years of Dental Practice:
- ☐ Less than 5 years
- ☐ 5 to 10 years
- ☐ 11 to 20 years
- ☐ More than 20 years

5. Specialty:
- ☐ General Dentist
- ☐ House Officer
- ☐ Oral Maxillofacial Surgeon
- ☐ Other (please specify): _____

6. Workplace:
- ☐ Private Clinic
- ☐ Government Hospital
- ☐ Academic Institution

7. What do you think is the most common site for oral cancer?
- ☐ Tongue
- ☐ Buccal Mucosa
- ☐ Lips
- ☐ Floor of Mouth

8. Who do you think has more chances of getting oral cancer?
- ☐ Men
- ☐ Women

9. Which of the following is the most common risk factor for oral cancer?
- ☐ Smoking
- ☐ Alcohol
- ☐ HPV
- ☐ Betel Nut
- ☐ Genetic Predisposition

10. Which early signs of oral cancer do you recognize? (Select all that apply):
- ☐ Persistent Ulcer
- ☐ Red/White Patches
- ☐ Unexplained Bleeding
- ☐ Difficulty in Swallowing
- ☐ Lump/Swelling

11. How often do you update yourself on oral cancer-related advancements?
- ☐ Regularly
- ☐ Occasionally
- ☐ Rarely
- ☐ Never

12. Do you believe oral cancer screening should be part of routine dental check-ups?
- ☐ Yes
- ☐ No

13. How confident are you in diagnosing oral cancer?
- ☐ Very Confident
- ☐ Somewhat Confident
- ☐ Not Confident

14. Do you think dentists have a major role in early detection of oral cancer?
- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree ☐ Strongly Disagree

15. Would you be interested in further training on oral cancer detection?
- ☐ Yes ☐ No

16. How often do you perform an oral cancer screening during routine check-ups?
- ☐ Always
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

17. What methods do you use for screening? (Select all that apply):
- ☐ Visual Examination
- ☐ Palpation
- ☐ Toluidine Blue Staining
- ☐ Biopsy

18. If you suspect a lesion to be cancerous, what is your next step?
- ☐ Observe and Monitor
- ☐ Refer to a Specialist
- ☐ Perform a Biopsy
- ☐ Prescribe Medication

19. Have you ever detected a case of oral cancer in your practice?
- ☐ Yes ☐ No

20. What are the main challenges you face in detecting oral cancer? (Select all that apply):
- ☐ Lack of Time
- ☐ Lack of Training
- ☐ Patient's Lack of Awareness
- ☐ Limited Referral Options

21. What do you think can improve early detection rates? (Select all that apply):
- ☐ More Training
- ☐ Public Awareness Campaigns
- ☐ Availability of Better Screening Tools