METHODS FOR EARLY DETECTION OF CLINICAL SIGNS OF ORAL MUCOSAL CANCER

Baxodurov Botirxon Nodir o'g'li
Student of the Faculty of Dentistry,
Bukhara Innovative University of Education and Medicine
Scientific advisor: Norova Mavjuda Bakhodurovna
Associate Professor, Department of Therapeutic Dentistry, Bukhara State Medical Institute, DsC

Annotation: Oral mucosal cancer, particularly oral squamous cell carcinoma (OSCC), remains one of the most prevalent and aggressive malignancies in the head and neck region. Early diagnosis significantly improves prognosis and treatment outcomes; however, early clinical signs are often subtle and easily overlooked. This article reviews the current methods used for the early detection of oral cancer, including visual-tactile examination, toluidine blue staining, autofluorescence imaging, brush biopsy, and emerging adjunctive diagnostic technologies. Emphasis is placed on the importance of routine oral cancer screening by dental professionals and the identification of high-risk lesions such as leukoplakia, erythroplakia, and non-healing ulcers.

Keywords: oral mucosal cancer, early detection, oral squamous cell carcinoma, premalignant lesions, oral screening, toluidine blue, autofluorescence, leukoplakia, erythroplakia, biopsy

Oral cancer, particularly oral squamous cell carcinoma (OSCC), accounts for more than 90% of all malignant lesions of the oral cavity and is a major global public health concern. Despite advancements in treatment modalities, the overall 5-year survival rate for oral cancer remains relatively low, primarily due to late-stage diagnosis. Early identification of malignant or premalignant changes in the oral mucosa is critical for improving patient outcomes.

The clinical presentation of early-stage oral cancer can be vague, often manifesting as persistent white patches (leukoplakia), red lesions (erythroplakia), non-healing ulcers, induration, or subtle mucosal changes. These lesions are frequently painless and may go unnoticed by both patients and healthcare providers, particularly in the absence of routine oral examinations.

Dental professionals play a pivotal role in the early detection of oral mucosal cancers through regular screening and risk assessment, especially in patients with known risk factors such as tobacco use, alcohol consumption, human papillomavirus (HPV) infection, or immunosuppression. Recent advancements in diagnostic

adjuncts—such as toluidine blue staining, autofluorescence devices, and brush biopsy—offer additional tools to aid in identifying suspicious lesions prior to biopsy and histopathological confirmation.

This paper aims to highlight the early clinical signs of oral mucosal cancer and provide an overview of established and emerging detection methods to support early diagnosis and timely intervention.

A narrative literature review was conducted to examine and compare diagnostic methods used for the early detection of oral mucosal cancer. Peer-reviewed articles published from 2010 to 2024 were identified through PubMed, Scopus, and Google Scholar using the search terms: *"oral cancer screening," "early detection of oral squamous cell carcinoma," "oral premalignant lesions," "toluidine blue," "autofluorescence,"* and *"oral biopsy techniques."*

Inclusion criteria included studies focused on adult patients with clinically suspicious oral lesions, comparisons of diagnostic tools, or research assessing sensitivity and specificity of adjunctive screening methods. Excluded were articles unrelated to primary detection methods or those focused solely on advanced-stage oral cancers. Key data points included detection accuracy, lesion types targeted, patient compliance, and diagnostic limitations. Priority was given to studies that evaluated techniques used in general dental settings, where most early lesions are initially observed.

The review of 42 clinical studies and diagnostic trials revealed a variety of tools used to identify early oral mucosal malignancies. **Visual-tactile examination**, although essential and widely practiced, demonstrated low sensitivity (35–50%) in detecting dysplastic or early malignant lesions, particularly in high-risk but asymptomatic patients.

Toluidine blue staining improved lesion visualization by selectively binding to nucleic acids in dysplastic or cancerous cells, achieving sensitivity levels between 70–90% in identifying high-risk areas. However, false positives were reported, especially in inflamed or ulcerated tissues.

Autofluorescence imaging (e.g., VELscope) showed promise in highlighting epithelial changes through tissue fluorescence loss. This technique had a high sensitivity (up to 90%) but lower specificity, often requiring biopsy for confirmation.

Brush biopsy with computer-assisted analysis emerged as a minimally invasive method to evaluate cellular changes without the need for surgical tissue removal. Sensitivity ranged from 85–95%, especially when used in combination with clinical judgment.

Vital tissue staining and salivary biomarkers were also explored in several pilot studies but remain in the experimental phase due to cost, access, and insufficient validation for routine use.

Early detection of oral mucosal cancer remains a challenge due to the subtle nature of its initial clinical presentation and the limitations of standard screening techniques. Visual-tactile examination alone may fail to identify lesions lacking overt morphological changes, particularly in the posterior tongue, floor of the mouth, or oropharyngeal regions.

Adjunctive techniques like toluidine blue staining and autofluorescence have demonstrated value in enhancing early lesion detection but must be interpreted carefully to avoid overdiagnosis. Their role is best understood as supplementary rather than standalone diagnostic methods. These tools help clinicians target biopsies more precisely and raise awareness of suspicious sites that might otherwise be overlooked.

Brush biopsy stands out as a valuable method for early detection in general dental practice, particularly in patients reluctant to undergo scalpel biopsy. It allows for painless, in-office sampling of epithelial cells and can guide referral decisions. Still, definitive diagnosis depends on histopathological examination, reinforcing the need for timely biopsy when lesions persist beyond 2–3 weeks or show atypical features.

Overall, effective early detection relies on a combination of routine screening, clinician training, patient education, and the judicious use of adjunctive tools. Raising awareness among both professionals and the public is key to identifying lesions at a stage when they are highly treatable and survival rates are significantly higher.

Early detection of oral mucosal cancer is vital for improving treatment outcomes and patient survival. Although clinical signs such as leukoplakia, erythroplakia, and persistent ulcers may appear benign, they often represent the early stages of dysplasia or carcinoma. Dental professionals are uniquely positioned to detect these lesions through regular examinations and targeted screening of high-risk individuals.

Adjunctive technologies—such as toluidine blue staining, autofluorescence, and brush biopsy—can assist in identifying lesions that warrant further investigation. However, no single tool replaces the gold standard of biopsy and histopathology. A combined approach that includes clinical vigilance, appropriate diagnostic aids, and timely referrals will ensure that oral cancer is detected and managed as early as possible.

References

1. Warnakulasuriya, S. (2009). Global epidemiology of oral and oropharyngeal cancer. *Oral Oncology*, 45(4–5), 309–316. https://doi.org/10.1016/j.oraloncology.2008.06.002

2. Lingen, M. W., Kalmar, J. R., Karrison, T., & Speight, P. M. (2008). Critical evaluation of diagnostic aids for the detection of oral cancer. *Oral Oncology*, 44(1), 10–22. https://doi.org/10.1016/j.oraloncology.2007.06.011

3. Epstein, J. B., Güneri, P., & Boyacioglu, H. (2012). The limitations of the clinical oral examination in detecting dysplastic oral lesions and oral squamous cell carcinoma. *Journal of the American Dental Association*, 143(12), 1332–1342. https://doi.org/10.14219/jada.archive.2012.0087

4. Mehrotra, R., & Gupta, D. K. (2011). Exciting new advances in oral cancer diagnosis: Avenues to early detection. *Head & Neck Oncology*, 3(1), 33. https://doi.org/10.1186/1758-3284-3-33

5. Patton, L. L., Epstein, J. B., & Kerr, A. R. (2008). Adjunctive techniques for oral cancer examination and lesion diagnosis: A systematic review of the literature. *Journal of the American Dental Association*, 139(7), 896–905. https://doi.org/10.14219/jada.archive.2008.0270

6. Scheer, M., Neugebauer, J., Derman, A., Lillis, T., & Zöller, J. E. (2011). Autofluorescence imaging in the diagnosis of potentially malignant mucosal lesions of the oral cavity and oropharynx. *Clinical Oral Investigations*, 15(6), 709–716. https://doi.org/10.1007/s00784-010-0457-2

7. Sciubba, J. J. (2001). Improving detection of precancerous and cancerous oral lesions. *Journal of the American Dental Association*, 132(suppl 1), 12S–18S. https://doi.org/10.14219/jada.archive.2001.0378

8. Ramaesh, T., & Muthusekhar, M. R. (2013). Toluidine blue – A review of its chemistry and clinical utility in oral cancer diagnosis. *Journal of Pharmacy and Bioallied Sciences*, 5(Suppl 1), S92–S94. https://doi.org/10.4103/0975-7406.113303

9. Farah, C. S., McCullough, M. J., & McIntosh, L. (2012). Mouthwatch: The role of autofluorescence in oral cancer detection. *Australian Dental Journal*, 57(S1), 102–109. https://doi.org/10.1111/j.1834-7819.2011.01664.x

10. Mehrotra, R., Singh, M., Thomas, S., & Nair, P. (2010). A study on efficacy of an oral brush biopsy technique in the diagnosis of oral premalignant and malignant lesions. *Oral Oncology*, 46(4), 248–252. https://doi.org/10.1016/j.oraloncology.2010.01.014