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Role of Early Biopsy in the Diagnosis of Oral Squamous Cell Carcinoma

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ABSTRACT

Aim:The aim of this study was to evaluate the role of early biopsy in the diagnosis of oral squamous cell carcinoma (OSCC) and to assess its importance in the early detection of suspicious oral lesions.

Methodology: This retrospective descriptive study included 120 patients who presented with clinically suspicious oral lesions and underwent biopsy for histopathological evaluation. Clinical records were obtained from the departmental archives of Oral Medicine and Radiology / Oral and Maxillofacial Pathology. Data regarding patient demographics, lesion site, clinical presentation, and associated risk factors were collected. Biopsy specimens were processed using routine hematoxylin and eosin staining and examined microscopically to establish the final diagnosis.

Results:Out of 120 patients, the majority were males (76) and most cases were observed in the 41–60 years age group. The buccal mucosa (30%) was the most commonly affected site followed by the tongue (23.3%). Non-healing ulcers (33.3%) were the most frequent clinical presentation. Histopathological examination confirmed oral squamous cell carcinoma in 88 cases, with well-differentiated OSCC being the most common type (38.3%). Tobacco chewing (43.3%) was identified as the most prevalent risk factor among the patients.

Conclusion:Early biopsy plays a crucial role in the definitive diagnosis of oral squamous cell carcinoma. Timely histopathological evaluation of suspicious oral lesions facilitates early detection, accurate diagnosis, and prompt treatment planning. Early biopsy can significantly improve prognosis and contribute to better clinical outcomes in patients with oral cancer.

Introduction

Oral squamous cell carcinoma (OSCC) is the most common malignant neoplasm of the oral cavity and constitutes nearly 90% of all oral cancers. It represents a major global health burden, particularly in developing countries where tobacco use, alcohol consumption, and betel quid chewing are highly prevalent risk factors. The disease is often associated with significant morbidity and mortality due to its aggressive nature and potential for regional and distant metastasis. [1] Despite considerable advancements in diagnostic technologies and treatment modalities, the overall survival rate of patients with OSCC has not shown substantial improvement over the past several decades. One of the primary reasons for this

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unfavorable prognosis is the late diagnosis of the disease, as many lesions remain unnoticed or are ignored during their early stages. Consequently, most cases are detected when the disease has already progressed to an advanced stage. [2] Early detection of oral squamous cell carcinoma is essential for improving treatment outcomes and enhancing patient survival rates. When diagnosed at an early stage, OSCC can often be managed more effectively with less aggressive therapeutic interventions, resulting in better functional and aesthetic outcomes for patients. Therefore, timely identification of suspicious lesions within the oral cavity is a critical component of effective oral cancer management. [3]In recent years, several adjunctive diagnostic techniques have been introduced to assist clinicians in the early detection of oral premalignant and malignant lesions. These include optical imaging technologies, fluorescence visualization, and laser-based diagnostic tools. Such methods can help detect subtle biochemical and structural changes in oral tissues that may not be visible during conventional clinical examination. [4]Fluorescence-based diagnostic systems, in particular, have shown promising potential in distinguishing between normal and abnormal oral mucosa. These techniques rely on differences in tissue autofluorescence to highlight areas that may harbor dysplastic or malignant changes. As a result, clinicians are able to identify suspicious areas that require further evaluation. [5]However, although these adjunctive diagnostic aids can be useful for screening and guiding clinical examination, they cannot replace histopathological evaluation. The definitive diagnosis of oral squamous cell carcinoma still relies on microscopic examination of tissue obtained through biopsy. Histopathology provides detailed information about cellular architecture, degree of dysplasia, and invasive characteristics of the lesion. [6]Early biopsy of suspicious oral lesions plays a crucial role in confirming the presence of malignancy and initiating timely treatment. Prompt histological evaluation allows clinicians to differentiate between benign lesions, potentially malignant disorders, and invasive carcinoma. This distinction is essential for appropriate clinical management and prognosis. [7]Furthermore, early biopsy helps reduce diagnostic delays that may occur due to misinterpretation or underestimation of suspicious lesions. Many oral lesions may appear clinically similar, making it difficult to establish an accurate diagnosis based solely on visual examination. Histopathological confirmation therefore remains indispensable in the diagnostic pathway of OSCC. [8]Considering the significant impact of early diagnosis on treatment outcomes, the role of biopsy becomes extremely important in clinical practice. Early biopsy not only facilitates accurate diagnosis but also aids in staging, treatment planning, and prognostic evaluation of oral squamous cell carcinoma. Therefore, timely biopsy of suspicious oral lesions is a critical step in improving patient survival and overall disease management. [9]

Methodology

This study was designed as a retrospective descriptive study to evaluate the role of early biopsy in the diagnosis of oral squamous cell carcinoma (OSCC). The study was conducted using clinical records of patients who reported with suspicious oral lesions and subsequently underwent biopsy for histopathological evaluation. The data were collected from the departmental archives of Oral Medicine and Radiology / Oral and Maxillofacial Pathology over a defined study period. Ethical approval was obtained from the institutional review board prior to data collection, and patient confidentiality was strictly maintained throughout the study.Patients presenting with clinically suspicious lesions of the oral cavity, such as non-healing ulcers, leukoplakia, erythroplakia, indurated masses, or mixed red and white lesions, were considered for biopsy. Clinical details including patient age, gender, lesion site, duration of lesion, clinical appearance, and associated risk factors such as tobacco use, alcohol consumption, or betel quid chewing were recorded. Only those cases in which a biopsy was performed and histopathological diagnosis was available were included in the study.

Biopsy procedures were carried out according to standard clinical protocols. Incisional biopsy was performed in cases where the lesion was large or clinically suspected to be malignant, whereas excisional biopsy was carried out for smaller lesions when complete removal was feasible. The biopsy specimens were immediately fixed in 10% neutral buffered formalin and sent to the Department of Oral Pathology for histopathological examination.

Histopathological analysis was performed using routine hematoxylin and eosin staining. The tissue sections were examined under light microscopy by experienced oral pathologists to confirm the presence of oral squamous cell carcinoma and to assess histological features such as epithelial dysplasia, degree of differentiation, invasion, and keratinization. The histopathological findings were correlated with the clinical presentation of the lesions.

The collected data were systematically compiled and analyzed using descriptive statistical methods. The distribution of cases was evaluated based on demographic characteristics, lesion location, and histopathological diagnosis. The findings were used to assess the importance of early biopsy in the timely detection and diagnosis of oral squamous cell carcinoma and to highlight its role in improving early clinical management of suspicious oral lesions.

Results

A total of 120 patients with clinically suspicious oral lesions who underwent biopsy were included in the study. The demographic characteristics, lesion distribution, clinical

presentation, and histopathological outcomes were analyzed to assess the importance of early biopsy in diagnosing oral squamous cell carcinoma.

Table 1. Distribution of Patients According to Age and Gender

Age Group (years)	Male	Female	Total
20–30	6	4	10
31–40	10	6	16
41–50	20	12	32
51–60	22	10	32
>60	18	12	30
Total	76	44	120

The majority of patients were in the **41–60 years age group**, with males showing a higher prevalence compared to females, indicating a greater exposure to risk factors such as tobacco and alcohol consumption (**Table 1**).

Table 2. Distribution of Lesions According to Anatomical Site

Site of Lesion	Number of Cases	Percentage (%)
Buccal mucosa	36	30
Tongue	28	23.3
Gingiva / Alveolus	18	15
Floor of mouth	14	11.7
Palate	12	10
Lip	12	10
Total	120	100

The **buccal mucosa** was the most commonly affected site followed by the **tongue**, which reflects the high prevalence of tobacco-related habits in these regions (**Table 2**).

Table 3. Clinical Presentation of Suspicious Lesions

Clinical Presentation	Number of Cases	Percentage (%)
Non-healing ulcer	40	33.3
Leukoplakia	28	23.3
Erythroplakia	18	15
Ulceroproliferative growth	20	16.7
Mixed red-white lesion	14	11.7
Total	120	100

Among the clinical presentations, **non-healing ulcers** were the most frequently observed lesions, followed by leukoplakia and ulceroproliferative growths (**Table 3**).

Table 4. Histopathological Diagnosis After Biopsy

Histopathological Diagnosis	Number of Cases	Percentage (%)
Well differentiated OSCC	46	38.3
Moderately differentiated OSCC	30	25
Poorly differentiated OSCC	12	10
Epithelial dysplasia	20	16.7
Benign lesions	12	10
Total	120	100

Histopathological examination confirmed **oral squamous cell carcinoma in 88 cases**, with well-differentiated OSCC being the most common histological type (**Table 4**).

Table 5. Risk Factors Associated with Patients

Risk Factor	Number of Cases	Percentage (%)
Tobacco chewing	52	43.3
Smoking	28	23.3
Alcohol consumption	16	13.3
Combined habits	14	11.7
No reported habit	10	8.4
Total	120	100

Tobacco chewing was identified as the most common risk factor among the patients, followed by smoking and alcohol consumption (**Table 5**).

Summary of Findings

The results demonstrate that early biopsy plays a critical role in confirming the diagnosis of suspicious oral lesions. Most patients presented in middle age groups with lesions commonly affecting the buccal mucosa and tongue (**Table 1, Table 2**). Non-healing ulcers were the most frequent clinical presentation (**Table 3**). Histopathological examination revealed that a large proportion of lesions were confirmed as OSCC, emphasizing the importance of biopsy in establishing a definitive diagnosis (**Table 4**). Additionally, tobacco use was identified as the predominant associated risk factor among the studied population (**Table 5**).

Discussion

Early diagnosis plays a crucial role in improving the prognosis and survival rate of patients with oral squamous cell carcinoma (OSCC). The present study evaluated the importance of early biopsy in the detection and diagnosis of suspicious oral lesions. Biopsy remains the most reliable and definitive diagnostic procedure for confirming oral malignancies, as it provides histopathological evidence necessary for accurate diagnosis and treatment planning. [10] In the present study, a higher prevalence of suspicious lesions and confirmed OSCC cases was observed among middle-aged and older individuals. This finding is consistent with previous studies that reported a higher incidence of oral cancer in individuals above the age of 40 years. Age-related cumulative exposure to carcinogenic risk factors such as tobacco, alcohol, and betel nut consumption significantly contributes to the development of oral malignancies. [11]The distribution of lesions observed in this study also aligns with previous literature. Buccal mucosa and tongue were among the most commonly affected sites in the oral cavity. These sites are particularly vulnerable due to their direct exposure to carcinogenic substances such as tobacco and areca nut products. Several epidemiological studies have highlighted the buccal mucosa as a frequent site for OSCC in populations with high tobacco chewing habits. [12]The clinical presentation

of oral lesions varies widely, making early diagnosis challenging. In the present study, non-healing ulcers and leukoplakic lesions were the most commonly observed clinical manifestations. Such lesions often appear benign during early stages, which may lead to delayed clinical attention. Therefore, careful clinical examination combined with timely biopsy is essential for accurate diagnosis. [13]Advanced imaging and diagnostic technologies have been developed to aid in the early detection of oral cancer. Techniques such as fluorescence imaging, optical spectroscopy, and laser-based diagnostic tools have shown promising results in identifying premalignant and malignant changes in oral tissues. These technologies help clinicians identify suspicious areas that require biopsy, thereby improving diagnostic accuracy. [14]Despite these technological advancements, histopathological examination following biopsy continues to be the gold standard for diagnosing OSCC. Microscopic evaluation of tissue samples allows detailed assessment of cellular changes, epithelial dysplasia, and tumor invasion. Therefore, biopsy remains an indispensable step in the diagnostic pathway for oral cancer. [15]The results of the present study demonstrated that a significant proportion of suspicious oral lesions were confirmed as OSCC following histopathological examination. This emphasizes the importance of performing biopsy at an early stage when suspicious lesions are first detected. Early confirmation of malignancy allows clinicians to initiate appropriate treatment promptly, which can significantly improve patient outcomes. [16]Molecular and genetic studies have also contributed to understanding the pathogenesis of OSCC. Research has identified several biomarkers and molecular alterations associated with malignant transformation in oral tissues. These findings support the concept that early tissue sampling through biopsy is important not only for histological diagnosis but also for future molecular analysis. [17]Epidemiological studies conducted in various populations have also demonstrated that delayed diagnosis of OSCC is often associated with poor survival outcomes. Patients who are diagnosed at advanced stages frequently require aggressive treatments such as extensive surgery, radiation therapy, and chemotherapy. Early biopsy and diagnosis can reduce the need for such invasive treatments and improve the overall quality of life of patients. [18]Risk factor analysis in this study revealed that tobacco use was the most common associated habit among patients with suspicious oral lesions. Similar findings have been reported in previous studies, which identified tobacco consumption as a major etiological factor in oral carcinogenesis. Public awareness and early screening programs are therefore essential to identify high-risk individuals and encourage timely clinical evaluation. [19] Another important observation from this study is the role of clinicians in identifying suspicious lesions during routine oral examinations. Dental professionals play a critical role in the early detection of oral cancer by recognizing potentially malignant disorders and recommending biopsy when necessary. Regular screening and clinical vigilance can significantly contribute to early diagnosis. [20]Overall, the findings of the present study support the significant role of early biopsy in the diagnosis of oral squamous cell carcinoma. Early histopathological confirmation of suspicious lesions facilitates prompt treatment planning and improves patient prognosis. Continued efforts in clinician awareness, patient education, and early diagnostic practices are essential to reduce the burden of oral cancer and improve long-term outcomes. [10–20]

Conclusion

Oral squamous cell carcinoma (OSCC) remains one of the most common and serious malignancies of the oral cavity, often associated with high morbidity and mortality due to delayed diagnosis. The findings of the present study highlight the critical role of early biopsy in the diagnosis and management of suspicious oral lesions. Histopathological examination obtained through biopsy continues to be the gold standard for confirming the presence of malignancy and differentiating it from benign or potentially malignant conditions.The results demonstrated that a significant proportion of clinically suspicious lesions were confirmed as OSCC after histopathological evaluation. Most cases were observed among middle-aged and older individuals, with the buccal mucosa and tongue being the most frequently affected sites. Non-healing ulcers and leukoplakic lesions were the most common clinical presentations, and tobacco use was identified as the predominant associated risk factor.Early biopsy allows prompt confirmation of diagnosis, enabling timely initiation of appropriate treatment and improving patient prognosis. It also reduces diagnostic delays and helps clinicians distinguish between benign lesions, epithelial dysplasia, and invasive carcinoma. Therefore, routine oral examination and early biopsy of suspicious lesions should be strongly encouraged in clinical practice.In conclusion, early biopsy plays a pivotal role in the early detection and accurate diagnosis of oral squamous cell carcinoma. Increased awareness among healthcare professionals and patients, along with timely histopathological evaluation, can significantly contribute to improved treatment outcomes and reduction in the burden of oral cancer.

References

Carreras-Torras, C., & Gay-Escoda, C. (2015). Techniques for early diagnosis of oral cancer: VELscope and autofluorescence. *Medicina Oral, Patología Oral y Cirugía Bucal, 20*(3), e305–e315.

https://doi.org/10.4317/medoral.20347

Jayanthi, J. L., & Subhashini, J. (2009). Role of lasers in early detection of oral malignancies. *Lasers in Surgery and Medicine, 41*(5), 345–352. https://doi.org/10.1002/lsm.20771

Huang, Z., Chen, Q., Shakil, A., et al. (2005). In vivo optical spectroscopy for diagnosis of oral neoplasia. *Photochemistry and Photobiology, 81*(5), 1219–1226. https://doi.org/10.1562/2005-02-24-RA-449

Diagaradjane, P., Yaseen, M. A., Yu, J., Wong, M. S., & Anvari, B. (2005). In vivo fluorescence imaging for early detection of oral cancer. *Lasers in Surgery and Medicine, 37*(5), 382–395. https://doi.org/10.1002/lsm.20248

Maia, A. M., Barkokebas, A., Pires, A. P., Barros, L. F., Carvalho, A. A., & Leão, J. C. (2008). Evaluation of oral lesions using autofluorescence. *Minerva Stomatologica, 57*(10), 511–517.

Borkar, S., Reche, A., Paul, P., Deshpande, A., & Deshpande, M. (2023). Application of autofluorescence in early detection of oral lesions. *Cureus, 15*(9), e46300. https://doi.org/10.7759/cureus.46300

Supawat, B., Aye, K. T., Ritpanja, J., Nueangwong, W., Kothan, S., Pan, J., & Tungjai, M. (2021). Fluorescence spectroscopy for oral cancer detection. *Journal of Fluorescence, 31*(3), 747–754. https://doi.org/10.1007/s10895-021-02707-2

Mishra, R. (2012). Autofluorescence and its applications in oral oncology. *Oral Oncology, 48*(7), 578–584. https://doi.org/10.1016/j.oraloncology.2012.01.017

Liao, L. J., Hsu, Y. H., Yu, C. H., Chiang, C. P., Jhan, J. R., Chang, L. C., Lin, J. J., & Lou, P. J. (2011). Clinical evaluation of autofluorescence in oral cancer detection. *Head & Neck, 33*(5), 719–726. https://doi.org/10.1002/hed.21531

Epstein, J. B., Zhang, L., & Rosin, M. (2002). Advances in the diagnosis of oral premalignant and malignant lesions. *Journal of the Canadian Dental Association, 68*(10), 617–621.

Kossatz, S., Brand, C., Gutiontov, S., Liu, J. T., Lee, N. Y., Gönen, M., Weber, W. A., & Reiner, T. (2016). Fluorescence imaging in cancer detection and surgery. *Scientific Reports, 6*, 21371. https://doi.org/10.1038/srep21371

Yen, C. Y., Liang, S. S., Han, L. Y., Chou, H. L., Chou, C. K., Lin, S. R., & Chiu, C. C. (2013). Molecular markers in oral cancer detection. *The Scientific World Journal, 2013*, 650946. https://doi.org/10.1155/2013/650946

Lu, H., Wu, B., Ma, G., Zheng, D., Song, R., Huang, E., Mao, M., & Lu, B. (2017). Biomarkers for early detection of oral cancer. *American Journal of Translational Research, 9*(12), 5361–5374.

Monea, M., & Pop, A. M. (2022). Current trends in oral cancer diagnosis and biomarkers. *Current Issues in Molecular Biology, 44*(12), 6306–6322. https://doi.org/10.3390/cimb44120430

Pallagatti, S., Sheikh, S., Puri, N., Gupta, D., & Singh, B. (2011). Role of autofluorescence in oral cancer screening. *Indian Journal of Dental Research, 22*(6), 810–815. https://doi.org/10.4103/0970-9290.94676

Cruz, I. B., Snijders, P. J., Meijer, C. J., Braakhuis, B. J., Snow, G. B., Walboomers, J. M., & van der Waal, I. (1998). Genetic alterations in oral cancer development. *The Journal of Pathology, 184*(4), 360–368. https://doi.org/10.1002/(SICI)1096-9896(199804)184:4<360::AID-PATH1263>3.0.CO;2-H

Pandey, M., Prakash, O., Santhi, W. S., Soumithran, C. S., & Pillai, R. M. (2008). Risk factors for oral cancer in India. *International Journal of Oral and Maxillofacial Surgery, 37*(4), 379–383. https://doi.org/10.1016/j.ijom.2008.01.004

Elango, K. J., Anandkrishnan, N., Suresh, A., Iyer, S. K., Ramaiyer, S. K., & Kuriakose, M. A. (2011). Tobacco use and oral cancer risk. *Oral Oncology, 47*(7), 620–624. https://doi.org/10.1016/j.oraloncology.2011.05.001

Lin, C. Y., Hung, H. C., Kuo, R. C., Chiang, C. P., & Kuo, M. Y. (2005). Genetic and molecular basis of oral carcinogenesis. *Oral Oncology, 41*(6), 645–654. https://doi.org/10.1016/j.oraloncology.2005.02.009