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Comparative analysis of conventional biopsy and liquid biopsy in oral squamous cell carcinoma

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Abstract:
Smoking is a major modifiable risk factor that adversely affects peri-implant tissue health and long-term dental implant survival. This hospital-based observational study compared 200 patients with functioning dental implants, including 100 smokers and 100 non-smokers, using standardized clinical and radiographic assessments of peri-implant health, marginal bone loss, peri-implant disease and implant survival. Smokers had significantly higher plaque index (1.94±0.49 vs. 1.43±0.38), probing pocket depth (4.21±0.82 vs. 3.18±0.67 mm), marginal bone loss (2.14±0.71 vs. 1.28±0.53 mm) and peri-implantitis prevalence (25% vs. 9%), with lower implant survival (93% vs. 99%; all $p<0.05$). Smoking significantly compromised peri-implant tissue health and implant survival, with heavier smoking associated with greater peri-implantitis and implant failure. These findings advance knowledge by reinforcing smoking cessation and individualized peri-implant maintenance as essential strategies for improving long-term implant outcomes.

Keywords: Oral squamous cell carcinoma (OSSC), conventional biopsy, liquid biopsy, histopathology, salivary biomarkers, circulating tumour DNA

Background:
Oral squamous cell carcinoma (OSSC) is the most prevalent form of oral cancer, representing almost 90% of all oral cancers globally. It continues to be a major public health problem due to its high incidence, late presentation, common regional metastasis and relatively poor long-term survival. The disease is especially common in developing countries, where the high prevalence of tobacco, areca nut and alcohol use make a significant contribution to the disease burden **[1]**. Although therapeutic modalities have improved, the prognosis of OSCC has improved only marginally over the past few decades, largely due to the late diagnosis of many patients. Thus, early and accurate diagnosis is the basis for better treatment outcomes and survival. Conventional biopsy remains the gold standard method for the diagnosis of OSCC and histopathological analysis of tissue remains the most reliable method. Conventional biopsy is usually necessary for the diagnosis of tumour architecture, degree of differentiation, depth of invasion, lymphovascular invasion, perineural invasion and surgical margin status, which are all important for treatment planning and prognosis **[2]**. The procedure, however, is invasive, necessitates local anaesthesia, is uncomfortable, can result in bleeding and can cause patient anxiety; and it can be subject to sampling bias because of intratumoral heterogeneity. In addition, the repeated tissue biopsies needed for monitoring disease are often impractical and there is a need for less invasive diagnostic options **[3]**. Saliva has been the focus of a great deal of interest as a biological fluid for liquid biopsy due to its direct contact with oral lesions and the ease of sample collection. Salivary diagnostics have several benefits: they are non-invasive, inexpensive, easily accepted by patients and can be repeated for follow-up. Saliva is a promising medium for early cancer detection and longitudinal cancer surveillance due to the advances in molecular biology, which have allowed the identification of a number of salivary biomarkers associated with the development and progression of OSCC **[4].** Gattuso *et al.* (2022) reviewed circulating biomarkers, including ctDNA, microRNAs, proteins and exosomes, as potential tools for oral cancer diagnosis and monitoring **[5]**. The molecular studies of oncology have progressed in recent years and liquid biopsy has become a new and promising non-invasive diagnostic method. Kinane *et al.* reviewed oral cancer sampling methods and molecular detection techniques. They concluded that tissue biopsy retains greater diagnostic value, while liquid biopsy offers advantages for screening **[6]**. Conventional biopsy involves taking a sample of the tumour and examining it, whereas liquid biopsy involves examining the components of the tumour that are found in blood, saliva, plasma or serum **[2]**. These components are circulating tumour DNA (ctDNA), circulating tumour cells (CTCs), cell-free nucleic acids, messenger RNA, microRNA, extracellular vesicles, exosomes and tumour-associated proteins. These biomarkers can also give important diagnostic and prognostic data and reduce patient discomfort, as they are the molecular properties of the primary tumour **[7].** Recently, EVs and exosomes are identified as significant transporters of tumour-derived genetic material. These vesicles contain microRNAs, DNA fragments, proteins and other bioactive molecules involved in tumour growth, angiogenesis, immune modulation and metastasis. The

expression profile of extracellular vesicle-associated microRNAs has been shown to be different in OSCC patients in several studies, which has led to the suggestion that they could be used as diagnostic markers that could be used to differentiate malignant from non-malignant oral lesions **[4]**. Palaia *et al.* (2022) identified several dysregulated circulating microRNAs with potential diagnostic and prognostic value in OSCC. They noted that larger studies are needed before routine clinical use **[8]**. While liquid biopsy has shown great promise, there are still some hurdles to overcome before it can be used in clinical practice. Gupta *et al.* (2024) highlighted the promise of liquid biopsy for OSCC detection and monitoring. They emphasized the need to standardize sample collection and biomarker analysis **[9]**. The use of a variety of biomarkers, differences in laboratory techniques, the absence of standardized analytical procedures and inconsistent diagnostic cut-offs remain barriers to broad clinical use **[10]**. However, recent systematic reviews have shown that liquid biopsy has great potential in the early diagnosis, therapeutic monitoring, detection of minimal residual disease and surveillance of recurrence, especially as a complementary method to conventional tissue biopsy **[11]**. Hazarika and Mahesh (2026) also highlighted the diagnostic potential of liquid biopsy. They emphasized the need for standardized protocols and large-scale validation **[12]**. Another key aspect of liquid biopsy is circulating tumour cells. These cells break away from the primary tumour and enter the bloodstream, possibly aiding in the spread of metastasis. Enrichment techniques, immunological detection methods and molecular characterisation have greatly improved the sensitivity and specificity of circulating tumour cell analysis. In addition, the integration of CTCs, CTC-DNA and salivary markers could further enhance the overall diagnostic value of liquid biopsy and offer a complete molecular characterization of each tumour **[13]**. Therefore, it is of interest to compare the diagnostic performance, concordance and clinical utility of conventional biopsy and liquid biopsy in patients with OSCC, to determine if liquid biopsy can be a reliable complementary diagnostic tool to aid early detection and clinical management of OSCC.

Materials and Methods:

Study design:

This will be a comparative diagnostic study with conventional tissue biopsy and liquid biopsy performed in patients with clinically suspected oral squamous cell carcinoma in a hypothetical setting.

Study population:

A total of 100 patients will be included in the study with clinically suspicious oral lesions suggestive of OSCC. Patients will be referred from the outpatient and inpatient departments of Oral Medicine, Oral Surgery, ENT or Oncology (as per institutional setup).

Sample size:

The sample size calculated was around 100 patients. Thus, 100 patients with clinically suspected OSCC will be involved in the study.

Inclusion criteria:

Patients will be included if they are 18 years or older, have clinically suspicious oral lesions (non-healing ulcer, indurated lesion, proliferative growth, erythroplakia, leukoplakia with suspicious features or ulceroproliferative lesion), are willing to undergo conventional biopsy and liquid biopsy and provide written informed consent.

Exclusion criteria:

Excluded are patients who have previously undergone surgery, chemotherapy, or radiotherapy for oral cancer; patients who have recurrent oral malignancy and are already being treated; patients who have inadequate biopsy samples; patients who refuse to provide blood or saliva samples; patients who have severe systemic illness that would make biopsy impossible; and patients who do not give informed consent.

Clinical evaluation:

A detailed clinical history will be taken and recorded including age, sex, occupation, socioeconomic status, tobacco chewing, smoking, alcohol consumption, use of areca nuts, duration of lesion, pain, bleeding, chewing difficulties, dysphagia, trismus, weight loss and previous oral potentially malignant disorder. Clinical examination will involve site, size, surface characteristics, induration, fixation, ulceration, bleeding tendency and cervical lymph node status.

Conventional biopsy procedure:

Conventional biopsy will be done under local anaesthetic and sterile conditions. Large lesions will be biopsied by incisional biopsy and small suspicious lesions may be biopsied by excisional biopsy. Tissue will be collected from the most representative area excluding necrotic areas. The specimen will be preserved in 10% neutral buffered formalin and sent to the pathologist.

Histopathological assessment:

Histopathological examination will be used as a reference standard. The tissue sections will be stained with haematoxylin and eosin. Diagnosis will be classified as benign lesion, epithelial dysplasia, carcinoma in situ or invasive squamous cell carcinoma. OSCC will be further classified as well differentiated, moderately differentiated or poorly differentiated carcinoma.

Liquid biopsy sampling:

Peripheral blood and saliva samples will be used in liquid biopsy. Venous blood will be obtained in about 5 mls in EDTA tubes. Saliva will be collected in sterile containers from patients who have not had any oral hygiene measures, food or drink for 30 minutes prior to collection.

Liquid biopsy biomarkers:

Selected OSCC-associated biomarkers may be included in the liquid biopsy panel, including circulating tumour DNA, cell free DNA, microRNA, salivary mRNA, protein biomarkers, circulating tumour cells and exosomal markers. Detection of the biomarker can be done by using PCR-based assays, ELISA, Next Generation Sequencing or institutional laboratory methods that have been validated.

Study variables:
The primary variables will be age, sex, risk habits, lesion site, clinical stage, histopathological diagnosis, tumour grade, liquid biopsy positivity, type of biomarker found and concordance between conventional biopsy and liquid biopsy.

Outcome measures:
The main outcome will be diagnostic concordance between conventional biopsy and liquid biopsy. Secondary outcomes will include sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of liquid biopsy using conventional histopathology as the reference standard.

Statistical analysis:
Data will be collected in Microsoft Excel and will be analyzed with SPSS or other statistical software. Categorical variables will be reported as frequencies and percentages. Continuous variables will be presented as mean ± SD. Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy will be determined. Chi-square test or Fisher's exact test will be used for categorical comparisons. P value < 0.05 will be considered statistically significant.

Results:
A total of 100 patients with clinically suspected oral squamous cell carcinoma (OSCC) were included in this hypothetical comparative observational study. Every participant underwent both conventional tissue biopsy followed by histopathological examination and liquid biopsy using peripheral blood and salivary biomarkers. Histopathological diagnosis obtained through conventional biopsy served as the reference standard for evaluating the diagnostic performance of liquid biopsy. Among the 100 participants, the 51–60-year age group constituted the largest proportion (33%), followed by patients older than 60 years (28%). Males represented 71% of the study population, showing a statistically significant predominance (p=0.021). Buccal mucosa was the commonest site of tumour occurrence (42%), followed by the tongue (26%). Most patients presented with Stage II (31%) or Stage III (34%) disease, indicating that OSCC was commonly diagnosed after progression beyond the earliest stage **(Table 1).** Conventional biopsy confirmed OSCC in 85% of patients and served as the diagnostic gold standard. Liquid biopsy correctly identified 81 of these cases, producing an overall diagnostic concordance of 93% with histopathology. Only four histopathologically positive cases were missed by liquid biopsy, while three false-positive biomarker-positive cases were observed. Although the overall positivity rates between the two techniques did not differ significantly (p=0.431), the high concordance rate was statistically significant (p=0.003), suggesting that liquid biopsy closely paralleled conventional biopsy for diagnosis **(Table 2).** Using histopathological diagnosis as the reference standard, liquid biopsy demonstrated an excellent sensitivity of 95.3%, indicating that the majority of OSCC cases were accurately detected. The specificity was 80.0%, reflecting relatively few false-positive results. The positive predictive value reached 96.4%, indicating that patients with a positive liquid biopsy were highly likely to have histopathologically confirmed OSCC. The overall diagnostic accuracy was 93%, while a Cohen's kappa coefficient of 0.79 indicated substantial agreement between liquid biopsy and conventional biopsy (p<0.001) **(Table 3).**

Table 1: Demographic and clinicopathological characteristics of study population (n = 100)

Variable	Number (n)	Percentage (%)	p value
Age Group			0.284
<40 years	15	15.0	
41–50 years	24	24.0	
51–60 years	33	33.0	
>60 years	28	28.0	
Gender			0.021*
Male	71	71.0	
Female	29	29.0	
Primary Site			0.039*
Buccal mucosa	42	42.0	
Tongue	26	26.0	
Gingivobuccal sulcus	18	18.0	
Floor of mouth	8	8.0	
Others	6	6.0	
Clinical Stage			0.017*
Stage I	14	14.0	
Stage II	31	31.0	
Stage III	34	34.0	
Stage IV	21	21.0	

Table 2: Comparison between conventional biopsy and liquid biopsy findings

Diagnostic Parameter	Conventional Biopsy	Liquid Biopsy	p value
Positive for OSCC	85 (85.0%)	81 (81.0%)	0.431
Negative for OSCC	15 (15.0%)	19 (19.0%)	
True Positive	–	81	
False Positive	–	3	
True Negative	–	12	
False Negative	–	4	
Diagnostic Concordance	–	93.0%	0.003*

Table 3: Diagnostic performance of liquid biopsy compared with conventional histopathology

Parameter	Value (%)	95% Confidence Interval
Sensitivity	95.3	89.8–98.2
Specificity	80.0	56.3–94.3
Positive Predictive Value	96.4	91.2–99.0
Negative Predictive Value	75.0	50.9–91.3
Overall Diagnostic Accuracy	93.0	86.2–97.1
Cohen's Kappa	0.79	p <0.001*

Discussion:
Oral squamous cell carcinoma (OSCC) is the most common type of oral cancer and is a significant health burden globally due to its high prevalence, late detection, high local recurrence rate and high mortality rate. The overall 5-year survival rate is relatively low despite the advances in surgical techniques, radiotherapy,

chemotherapy, immunotherapy and molecular diagnostics, with many patients diagnosed with advanced disease. Therefore, the establishment of a reliable, minimally invasive diagnostic method that can detect OSCC at an early stage is an important research area in the present day. While conventional tissue biopsy is the gold standard for definitive diagnosis, recent advances in liquid biopsy have led to great interest as a complementary diagnostic tool that can provide real-time molecular information with minimal patient discomfort **[4].** This is a hypothetical study that aimed to compare the diagnostic utility of conventional biopsy and liquid biopsy in 100 patients with clinically suspected OSCC. The liquid biopsy showed a sensitivity of 95.3%, a specificity of 80.0% and a diagnostic accuracy of 93% in the identification of the majority of the cases of malignancy confirmed by histopathological examination. The results of this study indicate that liquid biopsy has a good potential to be used as an additional diagnostic tool alongside conventional biopsy, which is still the gold standard for tissue diagnosis. These findings have also been confirmed in recent systematic reviews that suggest that circulating tumour DNA (ctDNA), circulating tumour cells (CTCs), exosomes, extracellular vesicles and salivary microRNAs have potential diagnostic value in oral cancer but need to be further standardised for routine clinical use **[10].** The male predominance seen in the cohort is similar to the previously documented epidemiology of OSCC globally. Tobacco smoking, smokeless tobacco, chewing of betel quid and use of areca nuts and alcohol consumption are the major etiological factors contributing to the increased disease burden among men in many developing countries. Moreover, the peak in the fifth and sixth decades of life is due to the cumulative exposure to carcinogenic agents, chronic mucosal damage and progressive molecular changes that lead to malignant transformation **[11].** The high frequency of buccal mucosa as a commonest site of tumour in the present study is also consistent with the epidemiological pattern in South Asian populations where smokeless tobacco and areca nut products are placed in the buccal vestibule and thus constantly exposed to carcinogenic insults **[13].** The most important result of the present study was the high level of agreement between the liquid biopsy and the conventional histopathology. Liquid biopsy, with a small number of false negative and false positive results, correctly identified most histopathologically confirmed OSCC cases. These observations are biologically plausible since the continuous release of nucleic acids, proteins, extracellular vesicles and exosomes into blood and saliva by malignant cells. Gupta and Pervez (2026) reported altered circulating miR-196a1 and miR-126 levels across the OPMD–OSCC spectrum. Their findings support further investigation of circulating microRNAs as diagnostic biomarkers **[14]**. The analytical sensitivity of these biomarkers has been greatly enhanced by the use of modern molecular techniques, including quantitative polymerase chain reaction (qPCR), digital droplet PCR, next-generation sequencing (NGS) and multiplex microRNA analysis **[2, 15 and 16]** and has led to greater clinical applicability. Li *et al.* (2026) reviewed emerging epigenetic biomarkers and detection technologies for OSCC. They highlighted the need for large-scale validation and standardized analytical protocols **[17]**. The sensitivity in this study is similar to the upper limit of sensitivity reported in recent clinical studies for selected panels of salivary biomarkers and circulating tumour DNA assays. Cruz-Romero *et al.* (2026) reported strong discriminatory performance for salivary MMP-9 in OSCC. However, they emphasized the need for larger studies and external validation **[18].** Yadav *et al.* (2021) identified a nine-gene signature associated with OSCC pathogenesis. These findings provide molecular context for continued biomarker discovery, although the signature was not validated as a liquid-biopsy test **[19]**. The relatively low specificity of this hypothetical scenario, however, suggests that false positive molecular signals may sometimes be produced by inflammatory oral lesions, epithelial dysplasia, or technical variability. Thus, positive liquid biopsy results should always be read in conjunction with clinical examination and histopathological diagnosis, not as an independent diagnosis **[20].** One of the other benefits shown by liquid biopsy is that it is minimally invasive. Repeated sampling of blood or saliva can be done throughout treatment and follow-up without discomfort or procedural complications as compared to conventional biopsy. The serial monitoring of tumour-derived biomarkers can help identify recurrence, assess treatment response, detect minimal residual disease and monitor the emergence of therapeutic resistance. Uchibori *et al.* (2025) observed rising total cfDNA levels in patients who developed systemic metastases. Their findings suggest a potential role for cfDNA in disease monitoring **[21]**. This is especially useful in precision oncology, where the decisions for individual treatment are increasingly based on dynamic molecular profiling instead of a single baseline tissue sample **[22, 23].** However, the results of the present hypothetical study confirm that liquid biopsy cannot replace conventional tissue biopsy at the present time. Circulating biomarkers are not sufficient to assess tumour architecture, grade of differentiation, depth of invasion, lymphovascular invasion, perineural invasion, surgical margins and other morphological features, for which histopathological examination is still essential. Therefore, liquid biopsy should be considered as a complementary diagnostic tool at present, which can be used to complement conventional histopathological diagnosis **[3, 4 and 20].** Upadhyay *et al.* (2025) highlighted the value of patient-derived models and organoids in OSCC research. These models may support future investigations of tumour heterogeneity and personalized treatment **[24]**. The present study has a number of strengths, such as the direct comparison of both diagnostic modalities in the same patient group and the assessment of clinically relevant diagnostic performance indices. However, relatively small sample size, lack of long-term follow-up and combined biomarker panels with no individual marker validation, restrict direct clinical interpretation. Larger prospective multicentric studies with standardized laboratory procedures, artificial intelligence-driven biomarker analysis and the incorporation of genomic, transcriptomic, proteomic and metabolomic profiling will likely further enhance the diagnostic potential of liquid biopsy in

OSCC. As molecular diagnostics continues to improve, liquid biopsy could become a part of personalized oral cancer screening, prognosis, therapeutic monitoring and surveillance in the future **[25–27].**

Conclusion:

Conventional tissue biopsy remains the diagnostic gold standard for OSCC, while liquid biopsy shows potential as a minimally invasive adjunct. Liquid biopsy may complement conventional biopsy in early detection, treatment monitoring and recurrence surveillance, supporting personalized patient management. Larger prospective multicentric studies are needed to validate its diagnostic accuracy and establish its clinical utility in oral oncology.

References:

[1] Muralidharan S *et al. J Pharm Bioallied Sci.* 2025 **17**:S204. [PMID: 40511239]
[2] Naito Y & Honda K. *J Pers Med.* 2023 **13**:303. [PMID: 36836537]
[3] Radhika T *et al. J Oral Biol Craniofac Res.* 2016 **6**:S51. [PMID: 27900251]
[4] Gai C *et al. BMC Cancer.* 2018 **18**:439. [PMID: 29669525]
[5] Gattuso G *et al. Noncoding RNA.* 2022 **8**:60. [PMID: 36005828]
[6] Kinane DF *et al. Periodontol 2000.* 2024 **96**:316. [PMID: 38676371]
[7] Yang G *et al. BioTech (Basel).* 2022 **11**:5. [PMID: 35822813]
[8] Palaia G *et al. J Clin Exp Dent.* 2022 **14**:e875. [PMID: 36320672]
[9] Gupta S *et al. Expert Rev Mol Diagn.* 2024 **24**:311. [PMID: 38607339]
[10] Niekra P & Adamska P. *Int J Mol Sci.* 2026 **27**:677. [PMID: 41596329]
[11] Suri S *et al. Front Oral Health.* 2024 **5**:1426507. [PMID: 39157206]
[12] Hazarika S & Mahesh S. *Journal of Stomatology.* 2026 **79**:73. [DOI: 10.5114/jos.2026.160141]
[13] Salu P & Reindl KM. *Cancers (Basel).* 2024 **16**:1213. [PMID: 38539545]
[14] Gupta S & Pervez S. *Cureus.* 2026 **18**:e115008. [PMID: 42774891]
[15] Hu Y *et al. Sci Rep.* 2025 **15**:4645. [PMID: 39920257]
[16] Warnakulasuriya S & Patil S. *J Clin Med.* 2025 **14**:7598. [PMID: 41226995]
[17] Li Y *et al. Curr Issues Mol Biol.* 2026 **48**:680. [PMID: 42510921]
[18] Cruz-Romero SD *et al. J Appl Oral Sci.* 2026 **34**:e20250555. [PMID: 41779471]
[19] Yadav M *et al. 3 Biotech.* 2021 **11**:215. [PMID: 33928003]
[20] Pellegrini M *et al. Dent J (Basel).* 2025 **13**:479. [PMID: 41149126]
[21] Uchibori M *et al. Head Neck.* 2025 **47**:1411. [PMID: 39731308]
[22] Parihar AS *et al. J Pharm Bioallied Sci.* 2025 **17**:S278 [PMID: 40511222]
[23] Deorah S *et al. Oral Oncol Rep.* 2024 **9**:100162. [DOI: 10.1016/j.oor.2024.100162]
[24] Upadhyay V *et al. 3 Biotech.* 2025 **15**:295. [PMID: 40822425]
[25] Rouvinov K *et al. Diagnostics (Basel).* 2026 **16**:523. [PMID: 41750672]
[26] Aro K *et al. Front Public Health.* 2017 **5**:77. [PMID: 28443278]
[27] Bagewadi SB *et al. J Pharm Bioallied Sci.* 2025 **17**:S3587[PMID: 41846762]

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