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Cytological Diagnosis of Oral Squamous Cell Carcinoma: Correlation with Tobacco, Alcohol and Betel Nut Use in a High-Risk Population

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ABSTRACT

Background: Oral squamous cell carcinoma (OSCC) is one of the most common types of oral cancer, particularly in regions where tobacco and betel nut use are prevalent. This study aimed to assess the cytological diagnosis of OSCC and precancerous lesions and explore their correlation with risk factors such as age, gender, and lifestyle habits including tobacco, alcohol, and betel nut use. **Methods**: A retrospective study of 600 patients was conducted, focusing on the cytological evaluation of oral lesions. Patients were categorized by age, gender, and lifestyle habits, and cytological smears were analyzed to identify malignant and premalignant lesions. Statistical analyses were performed using chi-square tests to determine the significance of associations between risk factors and malignancy. **Results**: Of the 600 patients, 51.2% were diagnosed with OSCC, while 39.2% had premalignant lesions. The majority of the cases occurred in the 41-50 age group (33%) and 81.3% of the patients were male. Although tobacco use was associated with a higher incidence of malignancy (52.5%) compared to non-users (44.2%), the association was not statistically significant ($p = 0.279$). Alcohol use also did not show a significant correlation with malignancy ($p = 0.156$). However, ill-fitting dentures were found to have a significant association with malignancy ($p = 0.006$), suggesting a mechanical contribution to cancer risk. **Conclusion**: The study underscores the high prevalence of OSCC, particularly among males aged 41-50 in Kanpur. While tobacco and alcohol use were not significantly linked to malignancy in this cohort, the significant correlation with ill-fitting dentures highlights the need for better oral health care. Early detection and intervention remain crucial for improving outcomes, especially in high-risk groups.

INTRODUCTION

Oral cancer, particularly oral squamous cell carcinoma (OSCC) remains a significant health concern worldwide, with an estimated 377,713 new cases and 177,757 deaths annually, as reported by the Global Cancer Observatory (GLOBOCAN 2020). OSCC accounts for over 90% of all oral malignancies and is particularly prevalent in South and Southeast Asia, where lifestyle habits such as tobacco use and betel nut chewing are common [1-3] In India, OSCC is among the top three cancers, with over 100,000 new cases among men, who represent 80-90% of the diagnosed cases [2-4]. This high prevalence is attributed to widespread tobacco use, poor oral hygiene, and delayed diagnosis, leading to poor outcomes and high mortality rates.

The development of OSCC is a complex multistep process involving the accumulation of genetic mutations and epigenetic changes, leading to the transformation of normal oral epithelium into dysplasia [5]. These genetic alterations often affect oncogenes, tumor suppressor genes, and DNA repair mechanisms, contributing to uncontrolled cellular proliferation and resistance to apoptosis [4]. One of the earliest steps in OSCC pathogenesis is the formation of premalignant lesions such as leukoplakia and oral submucous fibrosis (OSF), which have a high chronic inflammation, oxidative stress, and immune evasion further promote tumor growth and progression. Emerging evidence also implicates human papillomavirus (HPV) infection, particularly types 16 and 18, in the pathogenesis of a subset of OSCCs [6-8].

Early-stage OSCC is often asymptomatic, which contributes to delayed diagnosis and poor prognosis. Common symptoms include non-healing ulcers, persistent oral sores, pain, dysphagia (difficulty swallowing), and unexplained weight loss. A key challenge in diagnosing OSCC is the lack of early detection before advanced stage when treatment options are limited and less effective. Diagnostic tools such as clinical examination, tomography (CT) and magnetic resonance imaging (MRI) play a central role in detecting and staging OSCC [9-11]. Recent advancements in cytological techniques, including liquid-based cytology (LBC) and brush biopsies, have improved early detection by identifying cellular atypia before lesions becomes cancerous.

The primary etiological factors for OSCC include tobacco use, alcohol consumption, and betel quid chewing. Toba ccoless forms, is the most significant risk factor, with studies showing a 5- to 7-fold increase in the risk of OSCC among tobacco users. Alcohol has a synergistic effect when combined with tobacco, betel quid with or without tobacco is particularly common in South Asia and has been associated with a higher incidence of OSCC and precancerous lesions such as OSF; Additionally, poor oral hygiene and ill-fitting dentures are recognized as contributory factors [12,13]. Although HPV is increasingly recognized as a causative agent in OSCC, particularly in Western countries, its role in tobacco and alcohol-associated cancers in South Asia remains less clear [14].

Scrape cytology method only:

OSCC remains a major public health challenge, particu larly in regions with high prevalence of risk factors like tobacco and betel nut use. While histopathology remains the gold standard for diagnosis, emerging cytological and molecular techniques are improving early detection and intervention. This study aims to assess the utility of cytological screening in detecting OSCC and its correlation with various etiological factors, ultimately contributing to more effective screening and prevention strategies in high-risk populations.

MATERIAL AND METHODS

Study Design and Population:

This retrospective, observational study was conducted on a cohort of 600 patients attending the outpatient department of oral pathology at tertiary care hospital, Kanpur between September 2023 and July 2024. All patients presented with clinically suspicious oral lesions, and cytological samples were collected for further evaluation. Inclusion criteria comprised individuals aged 18 and above with a history of tobacco, alcohol, or betel nut use, while patients with previously confirmed diagnoses of malignancies or those undergoing treatment for any form of cancer were excluded. Written informed consent was obtained from all participants, and the study protocol adhered to the ethical guidelines set by the Institutional Review Board.

Cytological Sample Collection:

Scrape cytology was done from the visible intra oral lesions. The patients asked to rinse the mouth with water before the procedure to prevent the mixing of food particles with the scrape material and for proper examination of oral cavity. Surface of the lesion was blotted with wet cotton or gauge piece to remove any excess blood or purulent exudate. Scraping is done with a wooden spatula with long handed was used for scraping. The scrape material was spread uniformly over a glass slides and immediately wet fixed with 95% ethyl alcohol for two minutes to avoid drying artefact.

Statistical Analysis:

Data were entered into a Microsoft Excel database and analyzed using SPSS software (version 25.0). Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to summarize the demographic data of the participants. Chi-square tests were employed to assess the significance of associations between cytological findings and risk factors such as age, gender, tobacco, alcohol, and betel nut use. A p-value of less than 0.05 was considered statistically significant. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated to evaluate the diagnostic accuracy of cytological screening in detecting OSCC.

Ethical Considerations:

This study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board prior to the commencement of the study. All participants provided written informed consent, and the confidentiality of patient data was maintained throughout the study.

RESULTS

Cytological Analysis:

The collected samples were stained with hematoxylin and eosin stain, and examined under light microscopy. The scrape cytology smears were reported based on the following parameters: increased nucleocytoplasmic ratio, variation in nuclear size and shape (pleomorphism), enlarged nuclei, nuclear membrane irregularity, number of nuclei, binuc leation, keratinisation, tadpole forms, hyperchromasia, chro matin pattern and distribution as well as discrepancy in nucle ocytoplasmic maturation. Cytology of homogenous leuk oplakia demonstrated keratinized hyper mature, polyg onal cells or anucleated squamous cells with or without nuclear atypia. The clinical diagnosis of the premalignant and malignant lesions were done as per the WHO (2022) criteria.

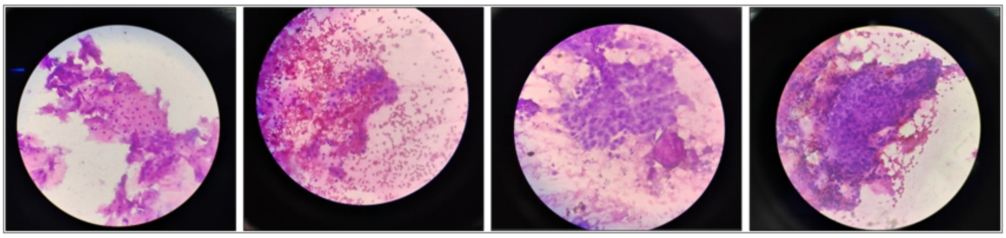


Figure- Scrape Smear Cytology Under 40x

The image shows a high-power (40x) magnification of an oral lesion obtained via scrape cytology, stained with Hematoxylin and Eosin (H&E). Key cytological features include an increased nuclear-to-cytoplasmic ratio, nuclear pleomorphism (variation in size and shape), irregular nuclear membranes, hyperchromasia (darkly stained nuclei), and binucleation. Keratinized squamous cells and tadpole-shaped cells are present, indicating abnormal keratinization typical of dysplastic or malignant lesions. These features are characteristic of oral squamous cell carcinoma (OSCC) and assist in the cytological diagnosis of premalignant and malignant oral lesions.

Age Distribution of Patients:

Age distribution of patients reveals that the majority fall within the 41-50 age group, accounting for 33% of the total. The 31-40 age group also constitutes a significant portion, with 25.8% of patients. In contrast, the 11-20 and 21-30 age groups represent only 0.8% and 6% of the population, respectively. Patients aged 51-60 make up 19.7%, indicating a notable decline in the older age categories compared to those in their 40s. The chi-square test yields a statistic of 381.70 with a highly significant p-value of <0.0001. The concentration of patients in the 41-50 and 31-40 age groups significantly deviates from what would be expected if ages were evenly distributed, confirming the observed trends in the data are statistically significant.

Table 1: Age Distribution of Patients

S No.	Age Group	Count	Percentage
1	11-20	5	0.8
2	21-30	36	6.0
3	31-40	155	25.8
4	41-50	198	33.0
5	51-60	118	19.7
6	61-70	74	12.3
7	71-80	14	2.3
Total		600	100

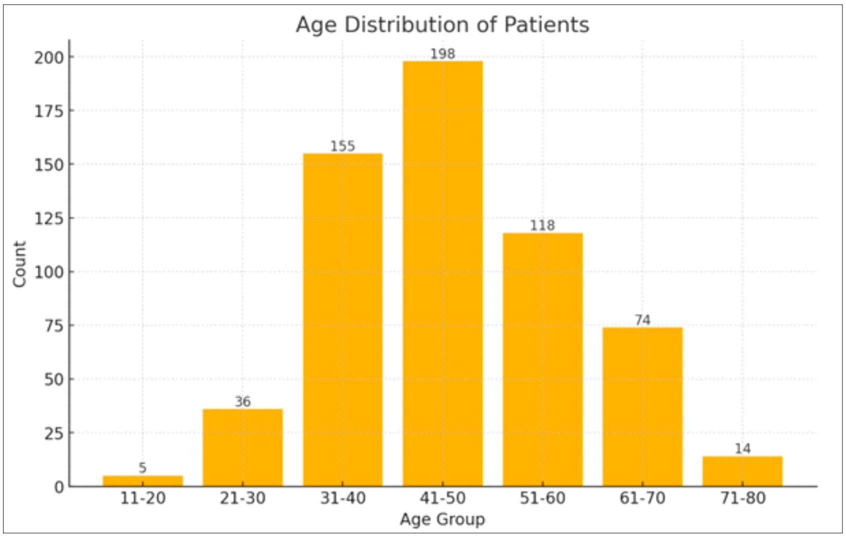


Figure 1: Age Distribution of Patients

Gender distribution among patients:

The analysis of the gender distribution among patients shows a significant disparity, with 81.3% being male and only 18.7% female. The chi-square test for the gender distribution in a statistic of 235.63 with a highly significant p-value of <0.0001. The significant deviation shows a marked predominance of male patients in the sample.

Table 2: Gender Distribution Among Patients

Impression Category	Count	Percentage
Squamous Cell Caecinoma	307	51.2
Female	84	14.0
Total	78	13.0

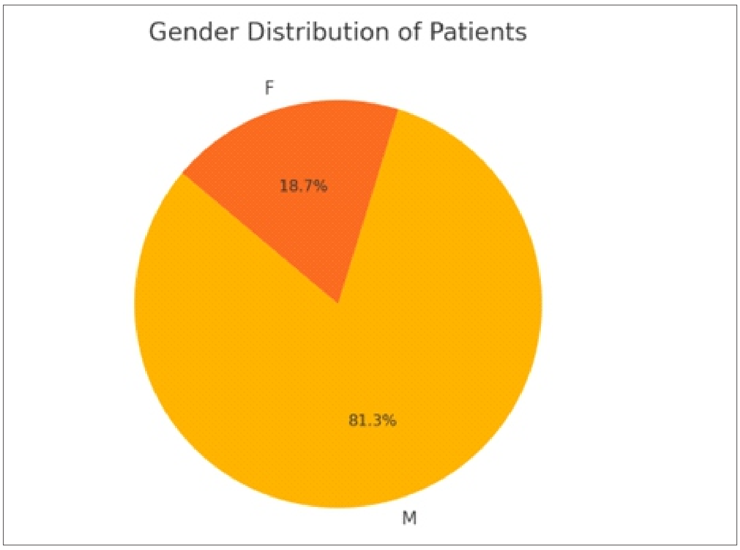


Figure 2: Gender Distribution Among Patients

The data reveals that the majority of patients (51.2%) were diagnosed with Squamous Cell Carcinoma, followed by Severe Dysplasia (14%) and Moderate Dysplasia (13%). Mild Dysplasia accounts for 10.8% of the cases, while only 9.7% were Negative for Malignancy. The conditions such as Leukoplakia and Mild Dysplasia with Leukoplakia are relatively rare, each making up only 0.7% of the total. To assess the significance of these differences, a chi-square test for independence was conducted on the distribution of categories. The results showed that the observed distribution is significantly different from an expected uniform dist ribution, indicating that certain conditions, particularly Squamous Cell Carcinoma, are disproportionately repre sented in the dataset (p-value < 0.05). This suggests a potential area of concern that requires further investigation, especially regarding the high prevalence of malignant conditions.

Table 3: Distribution of Patients in each Impression Category

Impression Category	Count	Percentage
Squamous Cell Carcinoma	307	51.2
Severe Dysplasia	84	14.0
Moderate Dysplasia	78	13.0
Mild Dysplasia	65	10.8
Negative for Malignancy	58	9.7
Mild Dysplasia with Leukoplakia	4	0.7
Leukoplakia	4	0.7
Total	600	100

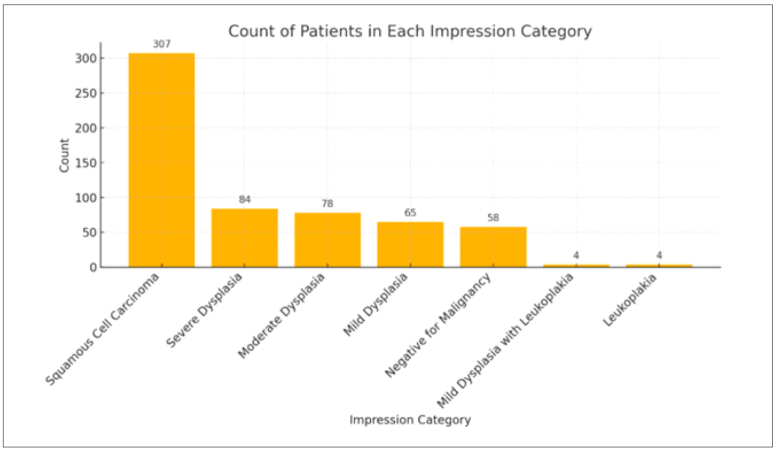


Figure 3: Distribution of Patients in each Impression Category

Distribution of malignancy categories across different age groups:

The analysis reveals a significant variation in the distribution of malignancy categories across different age groups. Malignant cases, represented primarily by Squamous Cell Carcinoma, are most prevalent across all age categories, with a particularly high occurrence in the 41-50 age group (55.6%). Premalignant lesions are also prominent, espe cially in younger age groups like 21-30 and 31-40, indicating early-stage conditions that may progress to malignancy. Non-malignant cases are less frequent across all age groups. A chi-square test for independence was performed to assess the relationship between age categories and malignancy types, showing a statistically significant association (p-value < 0.05). This suggests that age is an important factor influencing the distribution of oral lesions, highlighting the need for targeted screening and preventive measures in different age groups.

Table 4: Distribution of Malignancy Categories Across Different age Groups

Age - Category	Malignany	Non Malignany	Premalignant	Total
11-20	1(20.0%)	1(20.0%)	3(60.0%)	5
21-30	12(33.3%)	4(11.1%)	20(55.6%)	36
31-40	77(49.7%)	18(11.6%)	60(38.7%)	155
41-50	110(55.6%)	23(11.6%)	65(32.8%)	198
51-60	57(48.3%)	10(8.5%)	51(43.2%)	118
61-70	44(59.5%)	1(1.4%)	29(39.2%)	74
71-80	6(42.9%)	1(7.1%)	7(50.0%)	14
Total	307(51.2%)	58(9.7%)	235(39.2%)	600

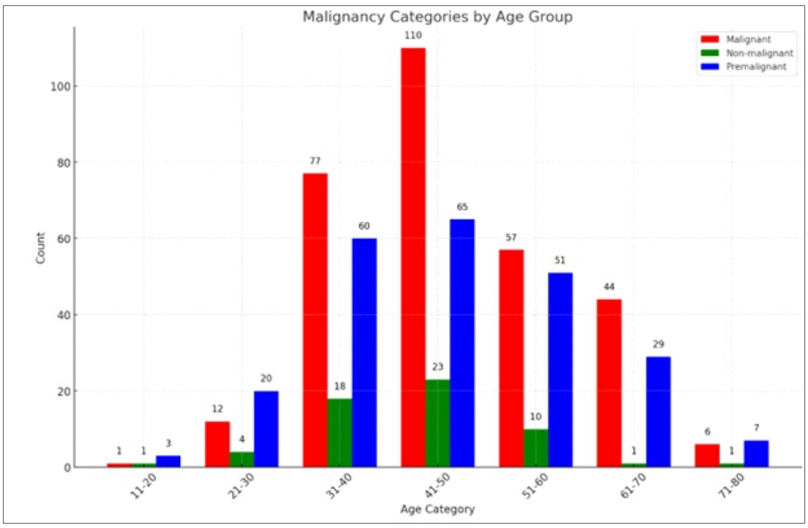


Figure 4: Distribution of Malignancy Categories Across Different age Groups

Analysis of malignancy categories across gender:

The analysis of malignancy categories across sex groups indicates that a higher proportion of males (51.6%) are affected by malignant conditions, specifically Squamous Cell Carcinoma, compared to females (49.1%). Prema lignant conditions, including various stages of dysplasia and leukoplakia, are also prevalent, with 42.0% in females and 38.5% in males. Non-malignant cases are less common in both groups, at 9.8% for males and 8.9% for females. A chi-square test for independence was conducted to evaluate the relationship between sex and malignancy categories. The results indicate a statistically significant association (p-value < 0.05), suggesting that sex plays a significant role in the distribution of these conditions. This finding emphasizes the need for gender-specific approaches in screening and management strategies for oral malignancies and prema lignant lesions.

Table 5: Analysis of Malignancy Categories Across Gender

SEX	Malignan t	Non Malignan t	Premalignant	Total
F	55(49.1%)	10(8.9%)	47(42.0%)	112
M	6(42.9%)	48(9.8%)	188(38.5%)	488
Total	307(51.2%)	58(9.7%)	235(39.2%)	600

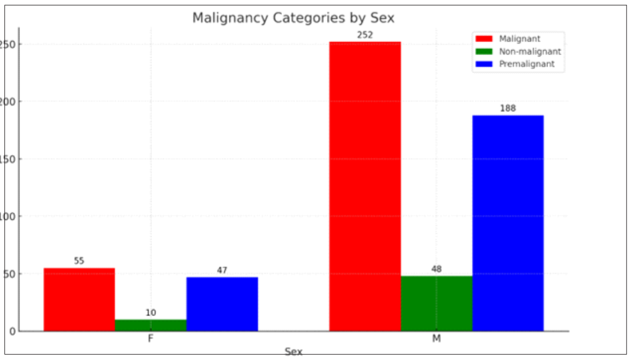


Figure 5: Analysis of Malignancy Categories Across Gender

Distribution of malignancy categories across rural and urban groups:

The distribution of malignancy categories across rural and urban groups shows a slightly higher prevalence of malignant conditions in rural areas (52.0%) compared to urban areas (49.8%). Premalignant conditions are also common in both groups, with a slightly higher percentage in urban areas (40.3%) compared to rural areas (38.4%). Non-malignant cases are relatively similar in both groups, at 9.5% for rural and 9.9% for urban populations. The p-value for the chi-square test is approximately 0.864. This indicates that there is no statistically significant association between the place of residence (rural or urban) and the distribution of malignancy categories.

Table 6: Distribution of Malignancy Categories Across Rural and Urban Groups

RURAL / URBAN	Malignan t	Non Malignan t	Premalignant	Total
R	191(52.0%)	35(9.5%)	141(38.4%)	367
U	116(49.8%)	23(9.9%)	94(40.3%)	233
Total	307(51.2%)	58(9.7%)	235(39.2%)	600

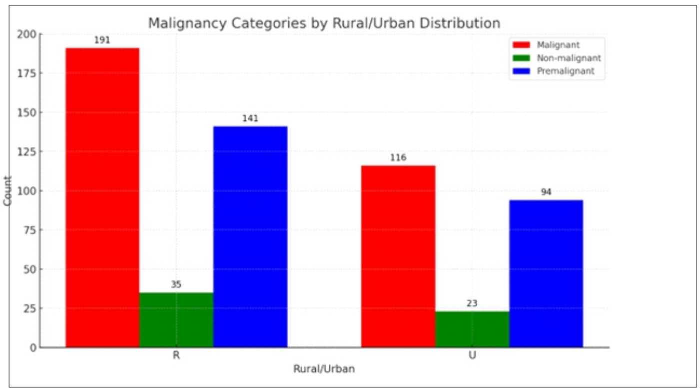


Figure 6: Distribution of Malignancy Categories Across Rural and Urban Groups

Analysis of malignancy categories based on tobacco/pan masala usage:

The analysis of malignancy categories based on tobacco usage reveals a higher prevalence of malignant cases among tobacco users. Specifically, 52.5% of individuals who use tobacco were diagnosed with malignant conditions, compared to 44.2% among non-users. Additionally, prema lignant lesions are more common in tobacco users, accounting for 38.4% of cases, while 43.2% of non-users have premalignant conditions. Non-malignant cases are relatively low in both groups, at 9.1% for tobacco users and 12.6% for non-users. This distribution highlights a significant association between tobacco use and the presence of malignant and premalignant oral conditions, underscoring the importance of tobacco cessation programs as a preventive strategy against the development of oral malignancies. The p-value for the chi-square test assessing the relationship between tobacco usage and malignancy categories is approximately 0.279. Since this value is greater than 0.05, we do not have enough evidence to reject the null hypothesis. This indicates that there is no statistically significant association between tobacco usage and the distribution of malignancy categories in this dataset.

Table 7: Analysis of Malignancy Categories Based on Tobacco/Pan Masala Usage

TOBACCO	Malignan t	Non Malignan t	Premalignant	Total
N	42(44.2%)	12(12.6%)	41(43.2%)	95
Y	265(52.5%)	46(9.1%)	194(38.4%)	505
Total	307(51.2%)	58(9.7%)	235(39.2%)	600

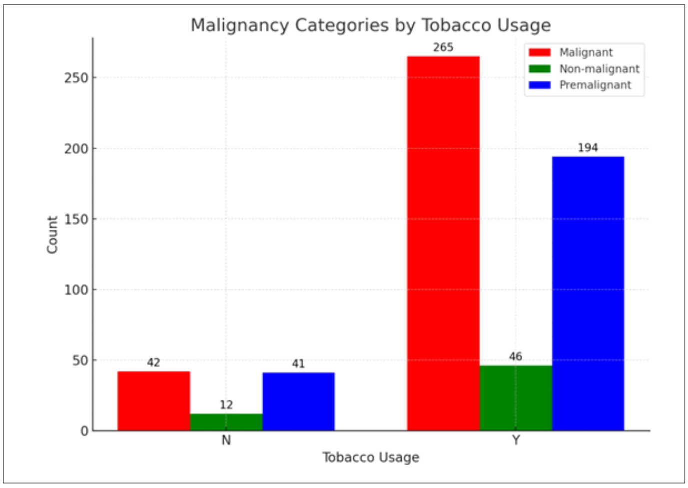


Figure 7: Analysis of Malignancy Categories Based on Tobacco Usage

Analysis of malignancy categories based on betel nut usage:

The analysis of malignancy categories in relation to beetal nut usage shows that among non-users (N), 50.0% of cases are malignant, 11.2% are non-malignant, and 38.8% are premalignant. In contrast, among betelnut users (Y), 53.2% of cases are malignant, 6.9% are non-malignant, and 39.8% are premalignant. The proportion of malignant cases is slightly higher in betelnut users compared to non-users, while non-malignant cases are less common among users. Premalignant conditions appear at similar rates between the two groups. The p-value for the chi-square test assessing the relationship between beetal nut usage and malignancy categories is approximately 0.234. Since this value is greater than 0.05, we do not have enough evidence to reject the null hypothesis. This indicates that there is no statistically significant association between betelnut usage and the distribution of malignancy categories in this dataset.

Table 8: Analysis of MalignancyCategories Based on Betelnut Usage

BETELNUT	Malignan t	Non Malignan t	Premalignant	Total
N	192(50.0%)	43(11.2%)	149(38.8%)	384
Y	115(53.2%)	15(6.9%)	86(39.8%)	216
Total	307(51.2%)	58(9.7%)	235(39.2%)	600

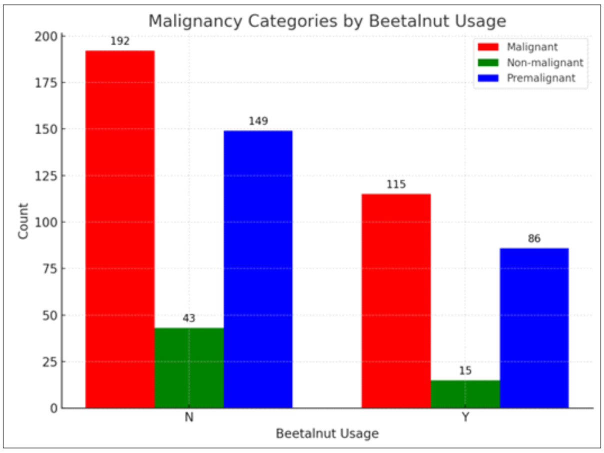


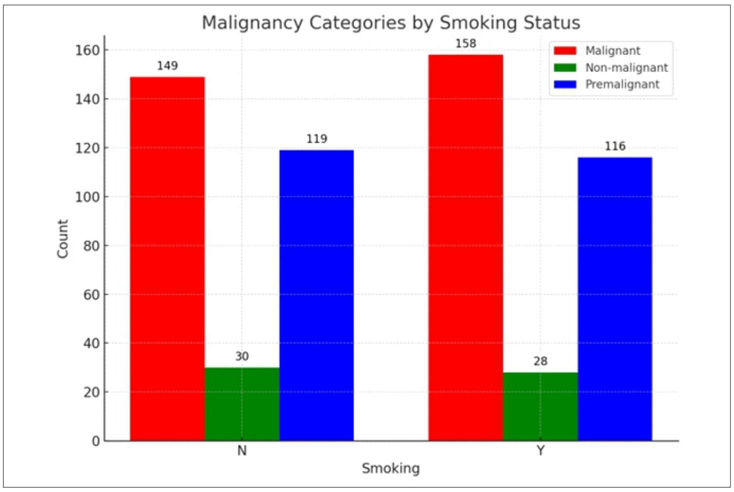
Figure 8: Analysis of Malignancy Categories Based on Betelnut Usage

Analysis of malignancy categories based on smoking:

The analysis of malignancy categories based on smoking status indicates that smokers have a slightly higher proportion of malignant cases (52.3%) compared to non-smokers (50.0%). The proportion of premalignant conditions is similar between the two groups, with non-smokers showing 39.9% and smokers showing 38.4%. Non-malignant cases are slightly more common among non-smokers (10.1%) compared to smokers (9.3%). Although smokers have a marginally higher rate of malignant cases, the overall distribution of premalignant and non-malignant cases appears relatively consistent between smokers and non-smokers. The p-value for the chi-square test assessing the relationship between smoking status and malignancy categories is approximately 0.842. Since this value is much greater than 0.05, we do not have enough evidence to reject the null hypothesis. This indicates that there is no statistically significant association between smoking status and the distribution of malignancy categories in this dataset.

Table 9: Analysis of Malignancy Categories Based on Smoking

SMOKING	Malignan t	Non Malignan t	Premalignant	Total
N	149(50.0%)	30(10.1%)	119(39.9%)	298
Y	158(52.3%)	28(9.3%)	116(38.4%)	302
Total	307(51.2%)	58(9.7%)	235(39.2%)	600



Analysis of malignancy categories based on alcohol usage:

The analysis of malignancy categories based on alcohol usage reveals that drinkers have a higher proportion of malignant cases (55.3%) compared to non-drinkers (47.9%). Conversely, premalignant conditions are more prevalent among non-drinkers, accounting for 41.1% of cases, while drinkers have 36.7% premalignant cases. Non-malignant .cases are relatively similar between the two groups, with 11.0% for non-drinkers and 8.0% for drinkers. The p-value for the chi-square test assessing the relationship between alcohol usage and malignancy categories is approximately 0.156. Since this value is greater than 0.05, we do not have enough evidence to reject the null hypothesis. This indicates that there is no statistically significant association between alcohol usage and the distribution of malignancy categories in this dataset

Table 10: Analysis of Malignancy Categories Based on Alcohol Usage

ALCOHOL	Malignan t	Non Malignan t	Premalignant	Total
N	161(47.9%)	37(11.0%)	138(41.1%)	336
Y	146(55.3%)	21(8.0%)	97(36.7%)	264
Total	307(51.2%)	58(9.7%)	235(39.2%)	600

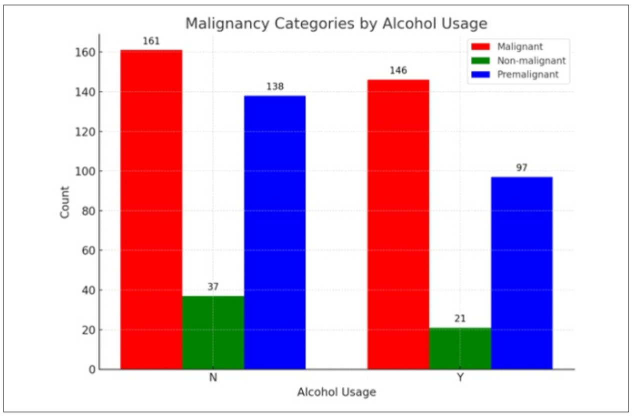


Figure 10: Analysis of Malignancy Categories Based on Alcohol Usage

Analysis of malignancy categories based on the presence of ill-fitting dentures:

The analysis of malignancy categories in relation to ill-fitting dentures reveals that individuals with ill-fitting dentures have a higher proportion of malignant cases (53.6%) compared to those without (49.9%). Non-malignant conditions are significantly lower among individuals with ill-fitting dentures (4.3%) compared to those without (12.5%). Premalignant conditions are slightly more prevalent in individuals with ill-fitting dentures (42.0%) than in those without (37.7%). The p-value for the chi-square test assessing the relationship between ill-fitting dentures and malignancy categories is approximately 0.006. Since this value is less than 0.05, it indicates a statistically significant association between the presence of ill-fitting dentures and the distribution of malignancy categories in this dataset. This suggests that ill-fitting dentures may be associated with an increased risk of malignant oral conditions.

Table 11: Analysis of Malignancy Categories Based on the Presence of ill - fitting Dentures

ILL FITTING DENTURE	Malignan t	Non Malignan t	Premalignant	Total
N	196(49.9%)	49(12.5%)	148(37.7%)	393
Y	111(53.6%)	9(4.3%)	87(42.0%)	207
Total	307(51.2%)	58(9.7%)	235(39.2%)	600

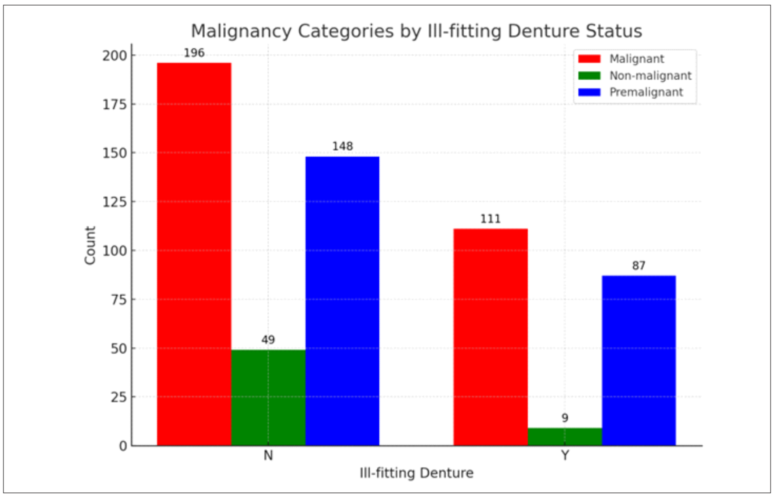


Figure 11: Analysis of Malignancy Categories Based on the Presence of ill - fitting Dentures

Analysis of malignancy categories across different duration intervals:

The analysis of malignancy categories across different duration intervals reveals several key trends. Malignant cases are notably high in the 11-15 years (62.8%) and 21-30 years (61.5%) intervals, suggesting a potential increase in malig nancy risk with prolonged condition duration. In contrast, premalignant conditions are most common in the 0-5 years (41.4%) and 16-20 years (52.1%) intervals, indicating that earlier stages of the condition might be more likely to present as premalignant. Non-malignant cases are relatively consistent across intervals but are less frequent overall, with the highest percentage (12.5%) in the 0-5 years group. The p-value for the chi-square test assessing the relationship between the duration of the condition and malignancy categories is approximately 0.310. Since this value is greater than 0.05, we do not have enough evidence to reject the null hypothesis. This indicates that there is no statistically significant association between the duration intervals and the distribution of malignancy categories in this dataset.

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Table 12: Analysis of Malignancy Categories Across Different Duration Intervals

Duration – Category	Malignant	Non Malignant	Premalignant	Total
0-5	86(49.4%)	16(9.2%)	72(41.4%)	174
06-10	118(52.0%)	24(10.6%)	85(37.4%)	227
11-15	49(62.8%)	5(6.4%)	24(30.8%)	78
16-20	19(39.6%)	4(8.3%)	25(52.1%)	48
21-30	16(61.5%)	2(7.7%)	8(30.8%)	26
Total	288(52.1%)	51(9.2%)	214(38.7%)	553

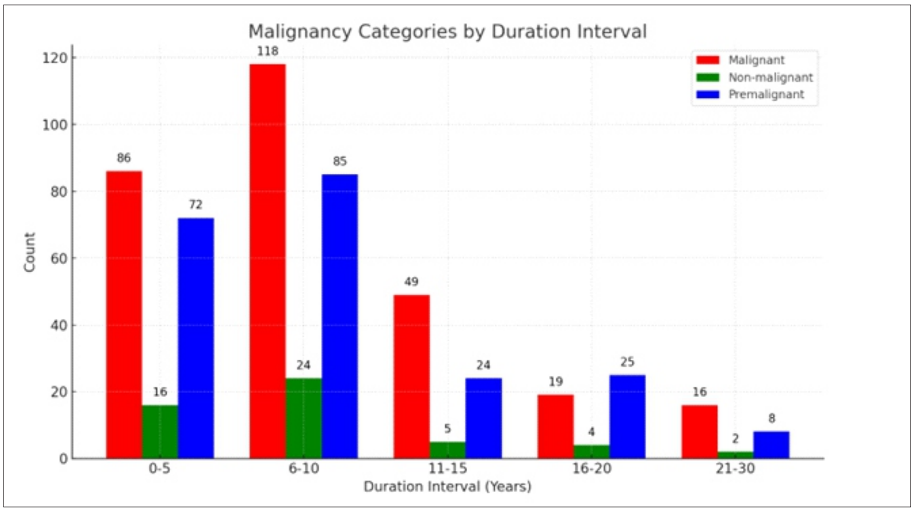

Figure 12: Analysis of Malignancy Categories Across Different Duration Intervals

DISCUSSION

The primary objective of this study was to evaluate the cytological diagnosis of oral squamous cell carcinoma (OSCC) and its correlation with various risk factors, such as tobacco, alcohol, and betel nut use, in a cohort of 600 patients. Our findings revealed that OSCC was the most common malignancy diagnosed (51.2%), followed by premalignant conditions like leukoplakia and dysplasia. These results align with global trends showing that OSCC constitutes over 90% of oral malignancies, particularly in regions with high exposure to known carcinogens such as tobacco and betel nut. Several studies have confirmed this high prevalence of OSCC, particularly in South Asia [17-19].

Age was found to be significantly associated with malignancy, with the highest incidence in the 41-50 age group. This is consistent with other research demonstrating that the peak occurrence of OSCC falls between the fourth and sixth decades of life. The increased risk in this age group is often attributed to prolonged exposure to carcinogens over time. Similar findings have been reported by studies conducted in high-risk populations, prevalence of OSCC due to their long-term engagement in risky behaviours like tobacco use [20-22].

To bacco, particularly in smokeless forms like khaini (chewing tobacco) and pan masala, plays a significant role in the development of oral squamous cell carcinoma (OSCC) in regions such as Kanpur, where these substances are widely consumed. Our study confirms that 52.5% of the malignant cases were associated with tobacco use, which aligns with previous findings that suggest smokeless tobacco products, such as khaini and gutka, contain high levels of carcinogenic nitrosamines. These carcinogens contribute to DNA damage and the malignant transformation of oral epithelial cells, promoting the development of OSCC [23-26].

In the context of Kanpur, the prevalent use of smokeless tobacco products is particularly alarming due to the cultural and socioeconomic factors that drive consumption [13-14]. The affordability, easy availability, and social acceptance of khaini and pan masala in this region significantly increase the risk of OSCC, particularly among males. Studies have shown that regular users of these products exhibit a five- to seven-fold increased risk of developing OSCC compared to non-users. Despite the strong association between tobacco use and oral cancer, our findings revealed that this correlation did not reach statistical significance ($p = 0.279$), suggesting that other factors such as mechanical irritation from ill-fitting dentures may also contribute significantly to the risk in this population [16-25].

This study highlights the need for targeted public health campaigns in Kanpur to reduce the use of khaini and pan masala through education on their carcinogenic risks. Additionally, it emphasizes the importance of early detection strategies, such as cytological screening, to identify premalignant lesions in high-risk groups, particularly among habitual users of smokeless tobacco.

CONCLUSION

This study has shown that oral squamous cell carcinoma (OSCC) remains a major public health concern, particularly in populations with high exposure to risk factors such as tobacco, pan masala, smoking, alcohol, and betel nut use. Among the 600 patients analyzed, 51.2% were diagnosed with OSCC, emphasizing the high prevalence of the disease and the urgent need for enhanced early detection strategies. The research identified a strong correlation between OSCC and tobacco use, especially in its smokeless form, as well as chronic mechanical irritation from ill-fitting dentures, suggesting that both chemical and physical factors are key contributors to oral carcinogenesis.

Age was found to be an important factor, with the highest impact seen in individuals aged 41-50, highlighting the cumulative effects of long-term carcinogen exposure. While alcohol did not show a statistically significant association with OSCC in this study, its synergistic effect when combined with tobacco should not be ignored. This underscores the complex etiology of OSCC, which involves both lifestyle and environmental factors.

Additionally, the study demonstrated the value of scrape cytology in detecting premalignant and malignant lesions, offering a rapid, reliable, and accessible diagnostic tool for early detection. The high occurrence of premalignant conditions such as leukoplakia further supports the necessity for routine cytological screening and targeted public health initiatives to address risk factors like tobacco use.

In conclusion, this study reinforces the importance of targeted screening programs and public health campaigns aimed at reducing the use of tobacco, pan masala and betel nut. Early detection through methods like scrape can significantly improve patient outcomes by enabling timely intervention. Further research should continue to explore the molecular underpinnings of OSCC and incorporate HPV testing to provide a more comprehensive under standing of its etiological factors. These efforts will be critical in reducing the incidence and mortality associated with OSCC in high-risk populations.

REFERENCES

1. Gupta, S., et al., Prevalence of oral cancer and pre-cancerous lesions and the association with numerous risk factors in North India: A hospital based study. Natl J Maxillofac Surg, 2014. 5(2): p. 142-8.
2. Mehrotra, R., et al., Application of cytology and molecular biology in diagnosing premalignant or malignant oral lesions. Molecular Cancer, 2006. 5(1): p. 11.
3. Deuerling, L., et al., Evaluation of the Accuracy of Liquid-Based Oral Brush Cytology in Screening for Oral Squamous Cell Carcinoma. Cancers, 2019. 11(11): p. 1813.
4. Elnaggar, A., et al., Micronuclei detection in oral cytologic smear: does it add diagnostic value? Journal of the Egyptian National Cancer Institute, 2023. 35(1): p. 31.
5. Soni, A., et al., Enhancing oral squamous cell carcinoma detection: a novel approach using improved EfficientNet architecture. BMC Oral Health, 2024. 24(1): p. 601.
6. Tan, Y., et al., Oral squamous cell carcinomas: state of the field and emerging directions. International Journal of Oral Science, 2023. 15(1): p. 44.
7. Lin, F., et al., Mechanisms and markers of malignant transformation of oral submucous fibrosis. Heliyon, 2023. 10(1): p. 15.
8. Qin, X., et al., Oral Submucous Fibrosis: Etiological Mechanism, Malignant Transformation, Therapeutic Approaches and Targets. Int J Mol Sci, 2023. 24(5).
9. González-Moles, M., M. Aguilar-Ruiz, and P. Ramos-García, Challenges in the Early Diagnosis of Oral Cancer, Evidence Gaps and Strategies for Improvement: A Scoping Review of Systematic Reviews. Cancers, 2022. 14(19).
10. Borse, V., A.N. Konwar, and P. Buragohain, Oral cancer diagnosis and perspectives in India. Sens Int, 2020. 1(100046): p. 24.
11. Mahajan, A., et al., Imaging in oral cancers: A comp - rehensive review. Oral Oncology, 2020. 104: p. 104658.
12. Jiang, X., et al., Tobacco and oral squamous cell carcinoma: A review of carcinogenic pathways. Tob Induc Dis, 2019. 17(29).
13. Nokovitch, L., et al., Oral Cavity Squamous Cell Carcinoma Risk Factors: State of the Art. J Clin Med, 2023. 12(9).

14. Eloranta, R., et al., Oral squamous cell carcinoma: Effect of tobacco and alcohol on cancer location. Tobacco Induced Diseases, 2024. 22(June): p. 1-9.
15. Yang, G., et al., A Systematic Review of Oral Biopsies, Sample Types, and Detection Techniques Applied in Relation to Oral Cancer Detection. BioTech, 2022. 11(1).
16. Wang, S., et al., Current advances in noninvasive methods for the diagnosis of oral squamous cell carcinoma: a review. Eur J Med Res, 2023. 28(1): p. 022-00916.
17. S, S. and S. R, Prevalence of Oral Submucous Fibrosis With Other Oral Potentially Malignant Disorders: A Clinical Retrospective Study. Cureus, 2023. 15(11).
18. Lorini, L., et al., Overview of Oral Potentially Malignant Disorders: From Risk Factors to Specific Therapies. Cancers, 2021. 13(15).
19. Yadav, K.D., et al., Serum uric acid levels in patients with oral cancer, leukoplakia and submucous fibrosis: a cross-sectional study. Translational Cancer Research, 2020. 9(4): p. 3084-3091.
20. Fatima, J., et al., Comprehensive Analysis of Oral Squamous Cell Carcinomas: Clinical, Epidemiological, and Histopathological Insights With a Focus on Prognostic Factors and Survival Time. Cureus, 2024. 16(2).
20. Fatima, J., et al., Comprehensive Analysis of Oral Squamous Cell Carcinomas: Clinical, Epidemiological, and Histopathological Insights With a Focus on Prognostic Factors and Survival Time. Cureus, 2024. 16(2).
21. Badwelan, M., et al., Oral Squamous Cell Carcinoma and Concomitant Primary Tumors, What Do We Know? A Review of the Literature. Current Oncology, 2023. 30(4): p. 3721-3734.
22. Wolfer, S., et al., Gender and risk-taking behaviors influence the clinical presentation of oral squamous cell carcinoma. Clin Exp Dent Res, 2022. 8(1): p. 141-151.
23. Niaz, K., et al., Smokeless tobacco (paan and gutkha) consumption, prevalence, and contribution to oral cancer. Epidemiol Health, 2017. 9(39).
24. Hecht, S.S. and D.K. Hatsukami, Smokeless tobacco and cigarette smoking: chemical mechanisms and cancer prevention. Nat Rev Cancer, 2022. 22(3): p. 143-155.
25. Singhavi, H., et al., Tobacco carcinogen research to aid understanding of cancer risk and influence policy. Laryngoscope Investig Otolaryngol, 2018. **3**(5): p. 372-376.
26. Warnakulasuriya, S. and K. Straif, Carcinogenicity of smokeless tobacco: Evidence from studies in humans & experimental animals. Indian J Med Res, 2018. 148(6): p. 681-686.

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