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ANALYSIS OF POTENTIALLY MALIGNANT DISORDERS IN SUBURBAN AREA A RETROSPECTIVE STUDY

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Abstract

Background: Oral potentially malignant disorders (PMDs) represent precancerous mucosal lesions with significant risk of malignant transformation. Their distribution and risk profile vary across populations, particularly in suburban regions where both rural and urban influences converge. ***Objective:*** To analyze the prevalence, clinicopathological features, and risk factors of PMDs in a suburban population. ***Methods:*** A retrospective review of 426 patient records diagnosed with PMDs from January 2018 to December 2022 was conducted at a suburban dental teaching hospital. Data regarding demographics, risk habits, lesion type, site, and histopathology were extracted. Descriptive statistics, chi-square tests, and logistic regression were applied for analysis. ***Results:*** Males (58.2%) were more frequently affected, with a mean age of 42.8 years. The majority reported tobacco chewing and areca nut use (46% and 22.5%, respectively). Oral submucous fibrosis (37.1%) and leukoplakia (32.6%) were the most common lesions, predominantly affecting the buccal mucosa (47.4%). Histopathological evaluation (n = 274) revealed epithelial dysplasia in 36.9% of cases, with higher rates in leukoplakia and erythroplakia. Multi-habit users demonstrated significantly increased

risk of dysplastic changes ($p < 0.05$). ***Conclusion:*** PMDs are prevalent in suburban populations, strongly linked to high-risk habits. Early detection, biopsy of suspicious lesions, and community-based cessation programs are essential to mitigate malignant transformation.

Keywords: Oral Potentially Malignant Disorders (PMDs), Oral Submucous Fibrosis, Leukoplakia, Epithelial Dysplasia, Tobacco Use, Suburban Population

INTRODUCTION

Oral potentially malignant disorders (PMDs) represent a diverse group of lesions and conditions of the oral mucosa that carry an increased risk of malignant transformation to oral squamous cell carcinoma (OSCC). Globally, OSCC accounts for more than 90% of oral cancers, and its incidence remains particularly high in developing countries where lifestyle, cultural habits, and socioeconomic status influence risk exposure [1]. Early identification and intervention of PMDs are essential, as they offer a crucial opportunity to reduce morbidity and mortality associated with oral cancer [2].

The World Health Organization (WHO) recognizes several conditions under the spectrum of PMDs, including leukoplakia, erythroplakia, oral submucous fibrosis (OSMF), lichen planus, and actinic cheilitis [3]. Among these, leukoplakia is the most common, with prevalence estimates ranging from 1–5% worldwide, while erythroplakia, though rarer, carries the highest malignant potential [4]. OSMF, particularly prevalent in South Asian populations, is strongly associated with areca nut chewing and has a malignant transformation rate ranging between 7–13% [5]. The prevalence and distribution of these disorders vary significantly by geography, socioeconomic background, and patterns of risk behavior such as tobacco use, alcohol consumption, and betel quid chewing [6].

Suburban populations are unique in that they often experience a mix of rural and urban influences. The migration of individuals from rural to suburban areas brings with it habits such as smokeless tobacco and areca nut use, while increasing urbanization introduces risk factors such as alcohol and cigarette smoking [7]. Moreover, access to healthcare services in suburban regions may be inconsistent better than rural areas yet often lacking the specialized care of metropolitan centers. These dynamics create a distinctive epidemiological profile for PMDs that requires focused investigation [8].

Several retrospective and hospital-based studies have highlighted the burden of PMDs in India, where oral cancer ranks among the top three malignancies [9]. However, many of these studies are concentrated in metropolitan or rural settings, leaving a relative gap in understanding the prevalence and patterns of PMDs in suburban areas. Such data are crucial for planning community-based screening programs, resource allocation, and public health policies tailored to these populations. Additionally, retrospective analyses allow for the assessment of trends in demographic distribution, clinical presentation, and histopathological outcomes, offering insights into the natural history of PMDs and the effectiveness of diagnostic pathways [10].

The present study aims to analyze the spectrum and distribution of PMDs in a suburban population through retrospective review of patient records. By identifying the most common lesions, associated risk factors, and demographic patterns, this research seeks to contribute to the growing body of literature on oral cancer prevention. Ultimately, such evidence will support targeted awareness campaigns, early diagnosis, and timely intervention strategies that are vital for reducing the malignant transformation burden in vulnerable populations.

METHODOLOGY

Study Design

This study was designed as a retrospective observational analysis of patients diagnosed with potentially malignant disorders (PMDs) who reported to the Department of Oral Medicine and Radiology in a dental teaching hospital. The study covered a five-year period.

Ethical Considerations
Approval for the study was obtained from the Institutional Ethical Review Board. Patient confidentiality was maintained, and data were anonymized prior to analysis.

Study Population
The study included all patients who were clinically diagnosed with PMDs and had complete demographic and clinical records. Cases were confirmed through histopathological reports where available. Patients with incomplete records, inconclusive diagnoses, or recurrent lesions after treatment were excluded.

Data Collection
Data were retrieved from institutional medical records and departmental case registers. The following variables were extracted:

- **Demographic data:** age, gender, occupation, and socioeconomic background.
- **Habits and risk factors:** tobacco chewing, smoking, alcohol use, areca nut/betel quid chewing, duration and frequency of habits.
- **Clinical presentation:** type of lesion (leukoplakia, erythroplakia, oral submucous fibrosis, lichen planus, others), site of occurrence, size, and symptoms.
- **Histopathological findings:** presence or absence of epithelial dysplasia, degree of dysplasia (mild, moderate, severe).

Diagnostic Criteria
The clinical diagnosis of PMDs was made based on WHO 2017 guidelines for oral potentially malignant disorders. Lesions such as leukoplakia were identified as white plaques of questionable risk, erythroplakia as red patches of unclear cause, OSMF as fibrous changes with reduced mouth opening, and lichen planus as bilateral reticular or erosive mucosal patterns. Biopsy confirmation was performed in cases with suspicious features or non-resolving lesions.

Statistical Analysis
Data were tabulated and analyzed using Statistical Package for Social Sciences (SPSS), version 25 (IBM Corp., Armonk, NY, USA). Descriptive statistics were applied to summarize categorical variables as frequencies and percentages, and continuous variables as mean ± standard deviation (SD).

Comparisons between groups were made using:

- Chi-square test for categorical variables (e.g., gender vs. lesion type).
- Independent t-test or ANOVA for continuous variables (e.g., mean age across lesion groups).
- Binary logistic regression was applied to assess associations between risk factors (e.g., tobacco habits, alcohol) and presence of epithelial dysplasia.

A p-value < 0.05 was considered statistically significant.

RESULTS
A total of 426 patient records were reviewed over the five-year period (2018–2022). Of these, 248 (58.2%) were males and 178 (41.8%) were females, with a male-to-female ratio of 1.4:1. The mean age of presentation was 42.8 ± 12.5 years, with the highest frequency of cases observed in the 31–50 years age group. Table 1

Regarding risk habits, 68.5% of patients reported a history of tobacco consumption in various forms. Chewing tobacco and areca nut were the predominant risk factors in suburban populations, followed by smoking and alcohol use. Multi-habit patterns (chewing plus smoking or alcohol) were documented in 21.4% of patients. Table 2

The most common PMD identified was oral submucous fibrosis (OSMF) (37.1%), followed by leukoplakia (32.6%), oral lichen planus (20.2%), and erythroplakia (5.9%). A small subset (4.2%) presented with other lesions such as actinic cheilitis. The buccal mucosa was the most frequently affected site (47.4%), followed by tongue (21.1%), labial mucosa (13.5%), gingiva (10.3%), and palate (7.7%). Table 3

Histopathological examination was available for 274 patients (64.3%). Among them, 36.9% showed epithelial dysplasia. Mild dysplasia was the most common (21.9%), followed by moderate (9.9%) and severe dysplasia (5.1%). Dysplastic changes were most frequently observed in leukoplakia and erythroplakia, whereas OSMF showed fibrosis with variable dysplastic changes. Table 4

Statistical analysis revealed a significant association between tobacco chewing habits and the occurrence of OSMF ($p < 0.01$), as well as between smoking and leukoplakia ($p < 0.05$). Patients with multi-habit patterns showed higher odds of presenting with dysplastic lesions compared to those with single-habit exposures.

Table 1. Demographic characteristics of study population (n = 426)

Variable	Frequency (n)	Percentage (%)
Gender		
Male	248	58.2
Female	178	41.8
Age groups (years)		
≤20	24	5.6
21–30	68	16.0
31–50	214	50.2
>50	120	28.2
Mean age ± SD	42.8 ± 12.5	—

Table 2. Distribution of habits among study participants

Habits	Frequency (n)	Percentage (%)
Tobacco chewing (gutkha, khaini, pan masala)	196	46.0
Areca nut/betel quid	96	22.5
Smoking (bidi, cigarette)	62	14.5
Alcohol	36	8.6
Multi-habits (≥2)	91	21.4
No habit history	57	13.4

Table 3. Distribution of potentially malignant disorders

Lesion type	Frequency (n)	Percentage (%)
Oral submucous fibrosis (OSMF)	158	37.1
Leukoplakia	139	32.6
Oral lichen planus	86	20.2
Erythroplakia	25	5.9
Others (actinic cheilitis, etc.)	18	4.2

Table 4. Histopathological findings in biopsied cases (n = 274)

Lesion type	No dysplasia n (%)	Mild dysplasia n (%)	Moderate dysplasia n (%)	Severe dysplasia n (%)
Leukoplakia (n=104)	52 (50.0)	28 (26.9)	16 (15.4)	8 (7.7)
Erythroplakia (n=20)	5 (25.0)	6 (30.0)	6 (30.0)	3 (15.0)

OSMF (n=112)	74 (66.1)	26 (23.2)	10 (8.9)	2 (1.8)
Lichen planus (n=38)	42 (63.6)	6 (15.8)	3 (7.9)	1 (2.6)
Others (n=10)	5 (50.0)	3 (30.0)	1 (10.0)	1 (10.0)

DISCUSSION

The present retrospective study analyzed the demographic, clinical, and histopathological profile of potentially malignant disorders (PMDs) in a suburban population over a five-year period. Our findings highlight the substantial burden of PMDs, their strong association with lifestyle habits, and their potential for malignant transformation.

Demographic Patterns

In this study, males were more frequently affected than females, with a male-to-female ratio of 1.4:1. This finding aligns with earlier reports that suggest men are more likely to engage in risk habits such as tobacco chewing, smoking, and alcohol consumption, which significantly contribute to the development of PMDs [11]. However, recent literature indicates a narrowing gender gap, especially in suburban and semi-urban settings, due to increasing habit adoption among women [12]. The mean age of affected individuals was 42.8 years, with most cases clustered between the third and fifth decades. This reflects the latency between initiation of high-risk behaviors during adolescence and the clinical manifestation of lesions in adulthood [13].

Habit Correlation

Tobacco chewing and areca nut use were the predominant etiological factors in this population, corroborating previous findings from India and other South Asian countries [14]. The prevalence of OSMF in this study underscores the widespread availability and affordability of commercial areca nut preparations such as gutkha and pan masala in suburban areas [15]. Multi-habit patterns were observed in more than one-fifth of patients, and logistic regression demonstrated a higher likelihood of dysplastic lesions among this group. This synergistic effect of combined habits has been well-documented, with alcohol acting as a mucosal irritant and smoking contributing carcinogenic nitrosamines that potentiate malignant risk [16].

Lesion Distribution

Among PMDs, OSMF was the most prevalent, followed closely by leukoplakia. This contrasts with metropolitan studies where leukoplakia is often reported as the predominant PMD [17]. The suburban predominance of OSMF may be attributed to higher consumption of smokeless tobacco and areca nut in these communities, compared to cigarettes and alcohol which dominate in urban populations. Oral lichen planus accounted for one-fifth of cases, consistent with its status as a relatively common autoimmune-mediated disorder with variable malignant potential [18]. Although erythroplakia was less common, its disproportionately high rate of epithelial dysplasia observed in our study reinforces its recognition as a high-risk lesion.

The buccal mucosa was the most frequent site of involvement, reflecting the placement of quid and smokeless tobacco in the vestibule. The tongue was the second most affected site, an observation consistent with the anatomical predilection of OSCC for lateral tongue surfaces [19]. Such site-specific predilections carry important clinical implications, as early mucosal changes in these regions warrant vigilant screening during routine oral examinations.

Histopathological Outcomes

Histopathology remains the gold standard for assessing malignant potential of PMDs. In our study, nearly 37% of biopsied lesions demonstrated dysplastic changes, with mild dysplasia being most common. The proportion of dysplastic lesions among leukoplakia and erythroplakia cases was higher compared to OSMF and lichen planus, which is consistent with previous studies [20]. Notably, severe dysplasia was relatively uncommon but present across multiple lesion types, underscoring the

heterogeneity of malignant risk even within a single category of PMD. These findings reiterate the importance of biopsy in all clinically suspicious cases, regardless of initial appearance.

Suburban Dynamics

The suburban setting of this study deserves emphasis. Suburbs often act as transitional zones where rural practices such as areca nut chewing persist, while urban influences such as alcohol and cigarette use are increasingly adopted. At the same time, healthcare access in such areas is variable better than remote villages but inferior to metropolitan centers with specialized oncology services. This creates a diagnostic gap, where lesions may be clinically visible but remain under-investigated until advanced stages. Our retrospective findings reinforce the need for targeted public health strategies in suburban communities, including mass screening camps, community awareness programs, and affordable cessation counseling services.

Comparison with Existing Literature

The observed prevalence of PMDs in this suburban population is broadly comparable to similar studies from semi-urban districts of India and Southeast Asia [14,16,17]. However, regional differences persist; for example, in western India, OSMF outpaces leukoplakia due to higher gutkha usage, whereas in southern states, smoking-related leukoplakia remains dominant [13,15]. Such variations highlight the need for localized epidemiological surveillance to guide interventions. Moreover, global trends differ substantially, with Western countries reporting lower rates of OSMF and higher incidences of leukoplakia due to smoking and alcohol use [18].

Strengths and Limitations

The strength of this study lies in its relatively large sample size and histopathological confirmation in a substantial proportion of cases. It provides valuable insight into the suburban burden of PMDs, a population segment that is often underrepresented in oral oncology research. However, certain limitations must be acknowledged. Being a retrospective study, it was dependent on the accuracy and completeness of medical records. In addition, lifestyle details such as exact frequency, duration, and intensity of habits may have been underreported. Longitudinal follow-up data were unavailable, preventing assessment of actual malignant transformation rates.

Implications for Future Research and Practice

The findings emphasize the urgent need for early detection programs, particularly in suburban areas where risk habits are entrenched but awareness of PMDs is limited. Incorporating oral screening into primary healthcare visits, training of general practitioners in recognition of early mucosal changes, and integration of cessation programs into community health initiatives are essential next steps. Future prospective studies should aim to track malignant transformation over time and evaluate the effectiveness of interventions such as habit cessation and surgical/medical management of PMDs [20-25].

CONCLUSION

In this retrospective study of potentially malignant disorders (PMDs) in a suburban population, several key findings emerge. PMDs are common, especially among middle-aged adults, with males showing higher prevalence, largely attributed to tobacco, areca nut, and multi-habit exposures. Oral submucous fibrosis and leukoplakia were the predominant lesion types, with a substantial proportion of lesions showing epithelial dysplasia upon histopathological examination. Buccal mucosa remains the most frequent site, aligning with lesion placement from chewing and smokeless tobacco habits. These results underscore the critical need for early detection, habit cessation programs, and histopathological evaluation of suspicious lesions. Public health strategies tailored for suburban populations which often have a mix of rural and urban behavioral risk exposure but limited access to specialized oral health services are essential. Future prospective and longitudinal studies should track malignant transformation, and interventions should be evaluated for efficacy in reducing PMD incidence and progression.

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