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Prevalence of potentially malignant disorders in oral cancer among tobacco and arecanut chewers: A clinicopathological study

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Abstract:
Tobacco and areca nut consumption in the form of quid is associated with oral potentially malignant disorders (OPMDs) and oral cancer. This cross-sectional analytical study included 2400 quid users aged ≥18 years and clinical diagnosis was made using modified WHO criteria with histopathological confirmation wherever required. OPMDs were observed in 1305 (54.3%) participants, with a higher prevalence among males and individuals aged 18–23 years, showing statistically significant association ($p < 0.05$). Oral leukoplakia (33.7%) and oral submucous fibrosis (27.6%) were the most common lesions, while oral cancer was seen in 1.2% of cases. Thus, data shows the need for early screening, awareness and preventive strategies to reduce the burden of oral malignancies among quid users.

Keywords: Oral potentially malignant disorders (OPMDs); tobacco; areca nut; quid; oral leukoplakia; oral submucous fibrosis; oral cancer; prevalence; rural population; risk factors

Background:
Tobacco and areca nut consumption continues to represent a significant global public health challenge, with an increasing burden in low- and middle-income countries such as India **[1]**. Both substances are widely consumed in various cultural and social contexts, often beginning at a young age and persisting due to their addictive properties. According to the Global Adult Tobacco Survey (GATS) India report, approximately 275 million adults in India use tobacco in some form, including a substantial proportion consuming smokeless tobacco **[2]**. This high prevalence highlights the magnitude of exposure to carcinogenic substances and the consequent risk of developing oral diseases. Over the past few decades, more people have switched from traditional tobacco products to commercial non-tobacco products, especially those with areca nut **[1]**. Many see areca nut as a safer choice because it is easy to get, affordable and widely accepted. However, studies show that areca nut is one of the most commonly abused psychoactive substances in the world, just after tobacco, alcohol and caffeine **[1]**. Nearly 600 million people worldwide use areca nut in different forms, either by itself or mixed with other substances **[3]**. The term "quid" was introduced following a consensus workshop held in Kuala Lumpur in 1996 to describe substances placed in the oral cavity, typically containing areca nut, smokeless tobacco, or both **[4, 5]**. This definition encompasses a wide range of commercially available products such as gutka, pan masala, khaini, zarda, mawa and other region-specific preparations **[6]**. These products often contain multiple harmful constituents, including tobacco-specific nitrosamines, polycyclic aromatic hydrocarbons and other carcinogenic compounds, which significantly contribute to oral mucosal damage **[1].** The harmful effects of tobacco and areca nut are well known. Tobacco causes cancer mainly because of nitrosamines and other toxic chemicals that damage DNA and cause genetic changes **[1]**. Areca nut also contains alkaloids like arecoline, which can create reactive oxygen species and lead to changes in cells that cause fibrosis and cancer **[7]**. These processes are important in starting and worsening mouth lesions. Diseases of the mouth lining linked to these habits can be grouped as malignant, non-malignant, or potentially malignant. The most common cancer is oral squamous cell carcinoma (OSCC), which often develops after oral potentially malignant disorders (OPMDs) **[1, 8]**. OPMDs include oral leukoplakia, erythroplakia, oral submucous fibrosis (OSMF), quid-induced lichenoid reactions, betel chewer's mucosa and tobacco pouch keratosis **[6, 8]**. These conditions have different risks of turning into cancer and are important signs for early treatment. Even though the risks are well known, many people, especially in rural areas, are not aware of how harmful tobacco and areca nut use can be or how important it is to detect OPMDs early **[1]**. Problems like limited access to healthcare, not enough

screening programs and social acceptance of these habits lead to late diagnosis and worse outcomes for oral cancer patients **[9–12]**. Therefore, it is of interest to find out how common oral potentially malignant disorders and oral cancer are among people who chew tobacco and areca nut in a rural area and also to look at how clinical findings match up with tissue analysis, to better understand disease patterns and help create focused prevention and treatment plans.

Materials and Methods:

This study was designed as a cross-sectional analytical investigation to determine the prevalence of oral potentially malignant disorders and oral cancer among individuals consuming quid containing tobacco and/or areca nut. A total of 2400 participants aged 18 years and above, including both males and females, were included. The cross-sectional design was selected as it allows assessment of disease burden and its association with exposure to quid at a single point in time within a defined population. Participants comprised current users of tobacco and areca nut in raw or processed forms, including both smokeless and smoked varieties. Individuals were enrolled based on their ongoing habit of quid consumption. Those who had discontinued the habit for two years or more were excluded to avoid potential bias related to past exposure. In addition, subjects with other deleterious habits such as alcohol intake, drug dependence, or use of other psychoactive substances were not included, as these factors could act as confounders. Participants, who were already undergoing treatment for oral potentially malignant disorders or oral cancer, as well as those unwilling to provide consent, were also excluded from the study. Ethical approval was obtained from the Institutional Scientific Committee prior to the initiation of the study. All participants were informed about the nature and purpose of the study and written informed consent was obtained before their inclusion. A comprehensive history of quid consumption was recorded for each participant, including details such as the type of product used, frequency and duration of the habit. This was followed by a thorough clinical examination of the oral cavity to identify any mucosal changes. The diagnosis of oral potentially malignant disorders was made based on modified World Health Organization (WHO) criteria **[8].** Examinations were carried out under proper illumination using standard clinical instruments. In cases where clinical findings were suggestive of potentially malignant or malignant changes, further confirmation was obtained through histopathological examination. This approach ensured accurate diagnosis and helped in correlating clinical observations with microscopic findings.

Results:

The collected data were coded and entered into Microsoft Excel and analyzed using SPSS version 21. The Chi-square test was applied to assess associations between variables and a p-value of <0.05 was considered statistically significant. Out of 2400 quid users, 1305 individuals (54.3%) were diagnosed with oral potentially malignant disorders (OPMDs) **(Table 1)**. Males constituted a slightly higher proportion of the study population (52.4%) **(Table 2)**.Age-wise analysis showed that the highest proportion of OPMDs was seen in the 18–23 years age group (21%), followed by other age groups **(Table 3)**. The association between younger age group (18–23 years) and occurrence of OPMDs was found to be statistically significant ($p < 0.05$).Among the different lesions observed, oral leukoplakia was the most prevalent (33.7%), followed by oral submucous fibrosis (27.6%). Other conditions included betel chewer's mucosa (15.3%), tobacco pouch keratosis (13.8%), quid-induced lichenoid reactions (8.1%), erythroplakia (0.2%) and oral cancer (1.2%) **(Table 4)**.Gender-wise distribution showed a higher prevalence of OPMDs among males compared to females and this association was statistically significant ($p < 0.05$) **(Table 5)**.

Table 1: Prevalence of OPMDs among quid users

Total Subjects	OPMDs Present	OPMDs Absent	Percentage (%)
2400	1305	1095	54.3%

Table 2: Gender distribution

Gender	Number of Subjects	Percentage (%)
Male	1258	52.4%
Female	1142	47.6%
Total	2400	100%

Table 3: Age-wise distribution of OPMDs

Age Group (years)	OPMDs Cases	Percentage (%)
18–23	274	21%
24–35	352	27%
36–45	339	26%
>45	340	26%
Total	**1305**	**100%**

Table 4: Distribution of OPMDs and Oral Cancer

Lesion Type	Number of Cases	Percentage (%)
Oral Leukoplakia	440	33.7%
Erythroplakia	3	0.2%
Oral Submucous Fibrosis (OSMF)	360	27.6%
Quid-induced lichenoid reactions	106	8.1%
Betel chewer's mucosa	200	15.3%
Tobacco pouch keratosis	180	13.8%
Oral Cancer	16	1.2%
Total	**1305**	**100%**

Table 5: Association of OPMDs with gender

Gender	OPMDs Present	OPMDs Absent	Total	p-value
Male	720	538	1258	<0.05
Female	585	557	1142	
Total	**1305**	**1095**	**2400**	

Discussion:

This study found that more than half of quid users (54.3%) had oral potentially malignant disorders (OPMDs). This result matches earlier research showing a high rate of OPMDs among people who regularly use tobacco and areca nut **[12]**. The common use of quid, especially in developing countries, remains a major public health issue because it is closely linked to oral cancer. More males (52.4%) were found among quid users and there was a clear link between being male and having OPMDs. This supports earlier studies that found men are more likely to develop these disorders, probably because they are more exposed to risk habits and tobacco use is more accepted among men **[13, 14]**. However, recent research shows the gap between men and women is closing, as more women are starting these

habits. This highlights the need for awareness programs aimed at both genders. The study also found that OPMDs were more common in younger people aged 18 to 23. This is worrying because it means these habits are starting earlier, leading to longer exposure to harmful substances. Other studies have noticed the same trend, linking it to aggressive marketing, peer pressure and easy access to quid products **[15, 16]**. Starting these habits young raises the long-term risk of developing cancer. Of the different lesions found, oral leukoplakia was the most common, followed by oral submucous fibrosis (OSMF). This matches other studies, which also report leukoplakia as the most frequent OPMD with a high risk of turning cancerous **[17, 18]**. OSMF is closely linked to areca nut use and is especially common in the Indian subcontinent, causing thickening of mouth tissues and limited mouth opening **[19]**.The high rate of OSMF in this study points to increased use of areca nut products. Other lesions like betel chewer's mucosa, tobacco pouch keratosis and quid-induced lichenoid reactions were also found in significant numbers. These result from ongoing irritation and chemical exposure from quid use. While some may seem harmless, their link to cancer-causing agents means they need close monitoring **[20].** Erythroplakia was rare in this study, which matches other research, but it is important because it carries a higher risk of becoming cancerous. The prevalence of oral cancer in the present study was 1.2%, which, although relatively low compared to OPMDs, remains clinically significant. Oral cancer was found in 1.2% of the study group. While this is lower than the rate of OPMDs, it is still important. This supports the idea that oral cancer often develops from earlier, detectable lesions, giving a chance for early diagnosis and treatment. Research shows that finding and treating OPMDs early can greatly lower the risk of cancer **[1].** Public health initiatives focusing on awareness, early screening and habit cessation are crucial, particularly in rural and underserved populations where access to healthcare is limited **[21]**. Community-based screening programs have been shown to be effective in early detection and reduction of oral cancer burden. Recent large studies have shown that oral cancer and OPMDs are rising in India, mainly because of widespread tobacco and areca nut use **[22, 23]**. These results agree with this study and highlight the urgent need for stronger rules on quid products and better tobacco control policies. A systematic review concludes that Tobacco-areca nut SLT poses the highest risk (especially for OSMF and dysplasia) **[24]**. Other studies also stated that OPMDs are highly prevalent among tobacco users **[25, 26]**. While this study has strengths, it also has some limitations. Because it is cross-sectional, it cannot prove that quid use causes OPMDs. Also, by excluding people with more than one habit, the results may not fully apply to real-life situations where these habits often overlap. In summary, this study confirms a strong link between quid use and the development of OPMDs and oral cancer. The high rates, especially among young people, show the urgent need for public health actions like education, early diagnosis and helping people quit harmful habits to lower future cases of oral cancer.

Conclusion:

Tobacco and arecanut consumption in the form of quid have caused havoc in the health sector in OPMDs and oral cancer. Hence, Government should make strict policies to ban the sale of quid to reduce mortality in future generations.

Advancement of knowledge:

The present study provides updated epidemiological evidence on the high burden of oral potentially malignant disorders among quid users in a rural population, highlighting a concerning shift toward younger age groups. It emphasizes the combined impact of tobacco and areca nut consumption as a major etiological factor in early mucosal changes leading to malignancy. The study also offers a clinicopathological correlation of various OPMDs, aiding in better identification and early diagnosis. Furthermore, it underscores the need for targeted screening and prevention strategies in underserved areas. These findings contribute to strengthening public health policies aimed at reducing the incidence of oral cancer.

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