

# Effect of the COVID-19 Outbreak on Patients with Oral Premalignant Lesions and Patients Requiring Maxillofacial Prosthesis in a Tertiary Dental Care Centre, Kerala, India: A Cross-sectional Study

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## ABSTRACT

**Introduction:** Oral cancer is one of the most prevalent cancers in India. The implementation of preventive programs by the government has played a crucial role in improving patient prognosis through early detection. However, the nationwide lockdown imposed due to the Coronavirus Disease 2019 (COVID-19) pandemic significantly affected patients with non COVID-19 illnesses and disrupted preventive healthcare services and clinics operated by various government agencies.

**Aim:** To compare the proportion of patients diagnosed with oral premalignant lesions among those screened one year before and one year after the COVID-19 outbreak in a tertiary dental care centre in Kerala, India.

**Materials and Methods:** The present cross-sectional study was in the Department of Prosthodontics, Government Dental College, Alappuzha, southern Kerala, India, from April 2019 to March 2021, based on medical records. The proportion of patients diagnosed with oral premalignant lesions before the COVID-19 outbreak (group 1) (April 1, 2019, to March 31, 2020) was compared with the proportion of similar cases after the outbreak (group 2) (April 1, 2020, to March 31, 2021). Additionally, the proportion of patients rehabilitated with maxillofacial prostheses during the same period was analysed.

Statistical analysis was conducted using the Shapiro-Wilk and Kolmogorov-Smirnov tests to assess data normality. Chi-square tests were performed to compare proportions, while an independent t-test was used to compare patient data before and after the COVID-19 outbreak. A p-value of <0.005 was considered statistically significant.

**Results:** In group 1, 6030 patients were screened, of which 81 (1.34%) had premalignant lesions and 14 (0.232%) required maxillofacial prosthetic rehabilitation. While in group 2, 19,963 patients were screened, of which 145 (0.72%) patients presented with premalignant lesions and 27 (0.135%) patients required maxillofacial prosthetic rehabilitation. The analysis revealed no significant differences in the proportion of patients diagnosed with oral premalignant lesions among the total screened population before and after the COVID-19 outbreak (p-value=0.8829). Similarly, there was no statistically significant change in the proportion of patients rehabilitated with maxillofacial prostheses between the two periods (p-value=0.9567).

**Conclusion:** The proportions of patients diagnosed with premalignant lesions among the total screened population and those rehabilitated with maxillofacial prostheses did not differ significantly before and after the COVID-19 outbreak.

**Keywords:** Cancer early detection, Cancer screening, Coronavirus Disease 2019, Oral cancer, Oral Leukoplakia, Precancerous conditions

## INTRODUCTION

Oral cancer remains a significant public health concern, with more than 50% of diagnosed cases proving fatal each year [1]. The prevalence of tobacco and alcohol consumption among men in India contributes to a higher incidence of oral cancer in Asian countries compared to Western regions. Visual examination of the oral cavity serves as a simple yet effective method for detecting asymptomatic oral cancers and precancerous lesions [2-6]. A cluster-randomised trial conducted by Sankaranarayanan R et al., evaluated the impact of visual screening on oral cancer mortality in a high-risk population in Kerala [7]. A Study carried out as part of a collaborative initiative between the International Agency for Research on Cancer (IARC) of the World Health Organisation (WHO) and the Regional Cancer Centre (RCC), Kerala, India, demonstrated that oral visual screening significantly reduces mortality in high-risk individuals and could potentially prevent an estimated 37,000 oral cancer-related deaths worldwide [3].

The COVID-19 pandemic first emerged as a pneumonia-like illness of unknown origin in Wuhan City, Hubei Province, China. It was later

identified that the causative agent was Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) [8]. On January 30, 2020, the World Health Organisation (WHO) declared the outbreak a Public Health Emergency of International Concern (PHEIC), and on March 11, 2020, it was officially classified as a global pandemic [9]. In Kerala, a state in India, the government imposed a COVID-19 lockdown on March 23, 2020, following the return of a medical student from Wuhan [10]. As a result, there was a notable decline in the number of patients seeking treatment at dental care centres, leading to significant modifications in hospital policies to curb viral transmission. Oral cancer screening camps, routine treatments, follow-up visits and tobacco cessation counselling sessions were either postponed or significantly scaled down due to pandemic-related restrictions. The International Cancer Screening Network (ICSN) conducted an online survey to evaluate the impact of the first wave of the COVID-19 pandemic on cancer screening services [11]. Most healthcare facilities temporarily suspended cancer screening programs, as they were unprepared to manage the crisis on such a large scale.

The present study Institution serves as a tertiary dental care centre in Kerala, catering to patients from nearby districts such as Pathanamthitta and Kollam who seek specialised dental treatments. Individuals with oral premalignant lesions are often referred from primary health centres, oral cancer screening camps and Taluk hospitals to the study Institution. However, community-based screening programs were minimal, and during the study period, the primary point of access for consultation and treatment remained tertiary dental care centres. A significant proportion of patients self-referred after detecting oral abnormalities through self-examination.

The present study aimed to assess the proportion of patients diagnosed with potentially malignant oral lesions in a tertiary care centre in Kerala, India, both one year before and one year after the COVID-19 outbreak, to evaluate the impact of the pandemic on oral cancer screening. Additionally, the study examined the number of patients who underwent maxillofacial prosthetic rehabilitation following cancer surgery during this period. A systematic review analysing the impact of COVID-19 on cancer screening services assessed 44 studies, of which only two focused on oral cancer. Findings from the review indicated that the pandemic significantly affected screening programs for colorectal, cervical, breast and prostate cancers [12]. The study also emphasised the importance of developing innovative cancer screening technologies to enhance screening efficiency in the post-COVID-19 era and strengthen preparedness for future pandemics.

Therefore, the present study was aimed to evaluate the impact of COVID-19 on the early detection, treatment and rehabilitation of oral cancer in central Kerala. This was assessed by comparing the proportion of patients diagnosed with premalignant oral lesions among the total number of patients screened in a tertiary dental care centre in Kerala, India, one year before and one year after the COVID-19 outbreak.

## MATERIALS AND METHODS

A cross-sectional study was conducted in the Department of Prosthodontics and Oral Medicine and Radiology, Government Dental College (a tertiary care referral centre), Alappuzha, southern Kerala, India, from April 2019 to March 2021. Study Institute provides specialised dental services to patients from Alappuzha and the neighbouring districts of Kollam and Pathanamthitta. The study aimed to compare the proportion of patients diagnosed with premalignant oral lesions among the total patients screened, as well as, the proportion of patients who underwent maxillofacial rehabilitation following cancer surgery, during two time periods: one year before the COVID-19 outbreak (April 1, 2019, to March 31, 2020) and one year after the outbreak (April 1, 2020, to March 31, 2021). The study protocol was submitted for review to the Institutional Ethics Committee of Government Thirumala Devaswom (TD) Medical College, Vandanam, Alappuzha, Kerala, India (ECR/122/Inst/KL/2013/RR-19), and ethical approval was granted (EC 105/2020) on November 19, 2020. Subsequently, permission was obtained from the Principal of Government Dental College, Alappuzha (No. E/1578/2020/GDCA, dated December 10, 2020), to access patient data from the outpatient register of the Institution. The study commenced after all the formalities and permissions were obtained from the authorities by January 2021.

**Inclusion criteria:** Data from all patients who reported to the Institution during the study period and had complete medical records were included in the study.

**Exclusion criteria:** Patients with incomplete records or those under ongoing review were excluded from the study.

## Study Procedure

The present study employed a cross-sectional retrospective design, utilising medical records from the institution. The collected data were then analysed and interpreted to assess relevant findings. All patients

underwent routine Oral Visual Examinations (OVE) to screen for oral premalignant lesions. The records of these patients were maintained in the Department of Oral Medicine and Radiology, while data on patients seeking maxillofacial prosthetic rehabilitation were archived in the Department of Prosthodontics for review and follow-up. For analysis, the study population was divided into two groups: group 1 included patients screened one year after the COVID-19 outbreak, while group 2 included patients screened one year before the outbreak.

**Variables:** The proportion of patients diagnosed with premalignant oral lesions among those who underwent visual screening at Government Dental College, Alappuzha, was assessed for one year before and one year after the COVID-19 outbreak. Additionally, the proportion of patients who underwent maxillofacial prosthetic rehabilitation following cancer surgery during the same periods was evaluated.

## STATISTICAL ANALYSIS

Data were collected and entered into Microsoft Excel for organisation. Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) software version 25.0 (IBM Corp., Armonk, NY). The Shapiro-Wilk and Kolmogorov-Smirnov tests were applied to assess the normality of the data, with the level of significance set at  $p\text{-value} < 0.005$ . Descriptive statistics were presented as frequency distributions. To compare proportions, a Chi-square test was conducted, while an independent t-test was used to analyse differences in patient data one year before and one year after the COVID-19 outbreak.

## RESULTS

The impact of COVID-19 on patients diagnosed with premalignant oral lesions and those who underwent maxillofacial prosthetic rehabilitation has been presented in [Table/Fig-1]. A substantial difference was observed in the total number of patients in each group, necessitating the calculation of proportions for comparison. In group 1 (after the COVID-19 outbreak), the proportion of patients rehabilitated with maxillofacial prostheses relative to the total number of patients was 0.232%. In group 2 (before the COVID-19 outbreak), a total of 19,963 patients were included in the study, among whom 145 (0.72%) patients presented with premalignant lesions. Additionally, 27 patients required maxillofacial prosthetic rehabilitation, accounting for 0.135% of the total patients in this group. A Chi-square test comparing the proportions of premalignant lesions between the two groups yielded a  $p\text{-value}$  of 0.8829, indicating no statistically significant reduction in the proportion of cases before and after the COVID-19 outbreak. Similarly, a Chi-square analysis of maxillofacial prosthetic rehabilitation rates produced a  $p\text{-value}$  of 0.9567, confirming no statistically significant change in the proportion of patients receiving prosthetic rehabilitation following cancer surgery between group 1 and group 2.

COVID-19 outbreak	Total no. of patients (n)	Proportion n (%)	
		Premalignant lesions	Maxillofacial prosthesis
Before (April 2019-March 2020)	19963	145 (0.72)	27 (0.135)
After (April 2020-March 2021)	6030	81 (1.34)	14 (0.232)

**[Table/Fig-1]:** Comparing the proportion of premalignant lesions and maxillofacial prosthesis among total number of patients before and after COVID-19 outbreak. Premalignant lesions: Chi-squared: 0.022; Degree of freedom: 1;  $p\text{-value}$ : 0.8829; Maxillofacial prosthesis: Chi-squared: 0.003; Degree of freedom: 1;  $p\text{-value}$ : 0.9567

The monthly mean distribution of patients based on different types of premalignant lesions and those who underwent screening has been presented in [Table/Fig-2]. The comparison included the total patient population, age groups, gender and specific oral conditions such as leukoplakia, lichen planus, Oral Submucous Fibrosis (OSMF), erythroplakia and malignancy, along with the number of patients rehabilitated with maxillofacial prostheses. A decline in the

Group	Monthly Mean	SD	Mean difference	SD error difference	F	t	p-value	95% confidence interval of the difference	
								Lower	Upper
Total									
Before	1663.58	300.944	1161.083	108.889	0.879	10.663	<0.001	934.281	1387.886
After	502.50	227.408						934.281	1387.886
Male									
Before	600.25	95.493	407.500	38.891	0.030	10.478	<0.001	326.844	488.156
After	192.75	95.034						326.844	488.156
Female									
Before	759.33	149.920	528.750	50.722	2.353	10.424	<0.001	423.559	633.941
After	230.58	91.634						422.276	635.224
Child									
Before	284.92	78.929	210.500	29.460	0.206	7.145	<0.001	149.405	271.595
After	74.42	64.689						149.268	271.732
Maxillofacial prosthesis									
Before	2.25	1.215	1.250	0.411	3.370	3.045	0.006	0.399	2.101
After	1.00	0.739						0.388	2.112
Lichen planus									
Before	3.50	2.431	0.917	0.748	4.340	1.225	0.234	-0.635	2.469
After	2.58	0.900						-0.689	2.522
Leukoplakia									
Before	2.00	1.595	0.833	0.505	1.452	1.650	0.113	-0.214	1.881
After	1.17	0.718						-0.241	1.908
Oral Submucous Fibrosis (OSMF)									
Before	4.25	3.019	2.667	0.942	13.250	2.830	0.010	0.713	4.621
After	1.58	1.240						0.654	4.679
Erythroplakia									
Before	0.83	0.718	0.250	0.283	0.036	0.883	0.387	-0.337	0.837
After	0.58	0.669						-0.337	0.837
Malignancy									
Before	1.50	1.446	0.667	0.482	6.647	1.383	0.181	-0.333	1.666
After	0.83	0.835						-0.348	1.681

**[Table/Fig-2]:** Comparison of overall patient data over a year before and after COVID-19 outbreak (using independent t-test).

number of patients across all categories was observed following the COVID-19 outbreak. Statistical analysis using an independent t-test, with a significance threshold of p-value <0.05, confirmed that the reduction in the total patient population, as well as, adult and paediatric patients, in addition to male and female patients, was statistically significant.

## DISCUSSION

The findings of the current study indicated no significant reduction in the proportion of patients diagnosed with premalignant lesions among the total screened population during the COVID-19 lockdown compared to the period before the lockdown. Similarly, there was no significant change in the proportion of patients rehabilitated with maxillofacial prostheses before and after the COVID-19 outbreak.

A cross-sectional observational study conducted in Taiwan examined the impact of COVID-19 on cancer screening utilisation, including cervical, breast, colorectal and oral cancer, using data from the Taiwan National Infectious Disease Statistics system. The study concluded that the pandemic influenced not only the overall use of cancer screening services but also patients' preferences for in-reach vs outreach screening programs [13].

Additionally, Han X et al., investigated the consequences of delayed cancer diagnoses and outcomes in the United States, particularly for early-stage cancers, which typically have favourable prognoses. Their findings revealed significant underdiagnosis of early-stage

cancers, with disparities linked to race, ethnicity, insurance status and socio-economic factors [14]. The Korean National Cancer Screening Survey (2019-2020) further analysed the impact of COVID-19 on cancer screening programs. Results showed a notable decline in one-year screening rates for stomach, colorectal, breast and cervical cancers during the pandemic [15].

Oral cancer is the leading cause of cancer-related mortality in males and ranks as the third most common cancer among women in India [16]. Most oral cancers progress through a premalignant phase, which can persist for several years before transforming into malignancy. The primary goal of oral cancer screening is not only to facilitate early cancer detection but also to identify and manage patients with premalignant lesions who are at an elevated risk of developing malignancy [17]. A comprehensive clinical examination of the oral cavity has been shown to detect up to 99% of oral cancers, with early diagnosis of precancerous lesions significantly improving survival rates and reducing mortality [18]. The most common premalignant lesions include lichen planus, OSMF, leukoplakia and erythroplakia [17].

The Kerala Oral Cancer Screening Trial (KOCST) demonstrated that four rounds of OVE by community health workers in high-risk populations resulted in a significant reduction in oral cancer mortality (81%) and incidence (38%). The study also highlighted the cost-effectiveness of systematic screening for oral cancer [19]. Notably, this was the only study in India that met the Cochrane review's inclusion criteria for evaluating the effectiveness of current oral

cancer screening methods. It involved over 190,000 participants across 13 clusters [19].

In 2016, the Government of India introduced an operational framework under the National Program for Prevention and Control of Cardiovascular Diseases, Diabetes, Cancer and Stroke, which recommended OVE every five years for adults aged 30-65 years [20].

Kerala is widely recognised for its high literacy rate, low infant and maternal mortality rates, and high life expectancy [19]. The Regional Cancer Centre (RCC) in Thiruvananthapuram, the state capital, plays a key role in cancer prevention and treatment across Kerala. The Community Oncology Department at RCC is actively involved in awareness campaigns, prevention initiatives, early detection and treatment programs for oral cancers. These efforts include school-based health promotion campaigns and outreach programs targeting vulnerable populations in remote areas. Additionally, mass media and exhibition campaigns are utilised to enhance public awareness of cancer prevention.

The RCC also conducts professional training programs, including trainer-trainee initiatives for paramedical staff and healthcare workers, tobacco cessation counselling and early cancer detection programs for high-risk groups. Through these trainer-trainee programs, a large number of healthcare professionals have been trained, enabling them to further educate and screen wider populations. During community-based oral cancer screening camps, individuals are educated on the carcinogenic risks of tobacco and alcohol and are taught oral self-examination techniques. Those reporting symptoms such as persistent soreness, sensitivity to spicy foods, ulcers, abnormal growths, or white/red patches in the oral cavity undergo further clinical evaluation. These awareness programs improve public understanding of early cancer symptoms and encourage individuals to seek screening and medical management at the nearest healthcare facility. The initiative has facilitated early referrals to cancer centres, timely diagnosis and appropriate treatment, ultimately improving cancer outcomes in Kerala [21].

In the years preceding the COVID-19 outbreak, the RCC implemented a women-centric cancer prevention and control program in Pathanamthitta, a neighboring district of Alappuzha. This initiative aimed to enhance awareness and motivate women in local community groups to adopt preventive measures and participate in early detection programs for oral and breast cancers [20]. As a result, individuals became more informed about the risks associated with carcinogen exposure and the importance of regular oral and breast self-examinations. Additionally, the Department of Community Dentistry at the study Institute, frequently organised oral cancer screening camps [22]. The Directorate of Health Services in Kerala also conducted multiple awareness and screening programs under the National Oral Health Mission prior to the COVID-19 pandemic [23]. By early 2020, a substantial portion of Kerala's population had gained awareness of the importance of cancer screening and early intervention in preventing the progression of oral cancer. Consequently, the COVID-19-related lockdown and restrictions had no significant impact on the number of patients diagnosed with oral premalignant lesions at the study Institute.

### Limitation(s)

The present study was limited by its single-centre design, as it was based solely on Institutional hospital records. The findings reflected the trends in oral cancer screening across three districts in Kerala. Conducting a multicentre study would provide a broader understanding of the impact of the COVID-19 lockdown on oral cancer screening and the detection of premalignant lesions across India.

## CONCLUSION(S)

There was no significant reduction in the proportion of patients diagnosed with premalignant lesions among the total screened population during the COVID-19 lockdown, nor was there a significant change in the proportion of patients rehabilitated with maxillofacial prostheses before and after the COVID-19 outbreak. However, there was a significant decline in the total number of patients following the COVID-19 outbreak. The oral cancer awareness programs conducted in the state of Kerala in previous years were beneficial, as individuals with suspected oral premalignant lesions came forward on an emergency basis for further screening and treatment, irrespective of the pandemic restrictions. The present study emphasises the need for more community-based awareness programs for the early detection of premalignant lesions and the treatment of oral cancer to reduce mortality.

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#### PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Dec 26, 2024
- Manual Googling: Jan 25, 2025
- iThenticate Software: Mar 01, 2025 (13%)

#### ETYMOLOGY: Author Origin

EMENDATIONS: 7

#### AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? No
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: Dec 25, 2024

Date of Peer Review: Jan 13, 2025

Date of Acceptance: Mar 03, 2025

Date of Publishing: Apr 01, 2025