Periodontitis and Oral Cancer risk: a case– control study

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ABSTRACT

Background: The prevalence of oral cancer is rising in India. Oral habits, lifestyle and lack of awareness are etiological factors associated with oral cancer. As the disease is multifactorial in nature, exploring the factors related to oral cancer may contribute to prevention, early diagnosis and treatment planning. Periodontal disease and its association with risk of developing oral cancer have been suggested in literature. The present study explores the relationship between oral cancer and severity of periodontal disease.

Methods: Two twenty patients (One Hundred and ten diagnosed with oral cancer and one hundred and ten without oral cancer) were recruited in this case-control study. A questionnaire was validated to determine the risk factors associated with oral cancer. Periodontal health status was recorded. Association was determined using chi-square and Mann–Whitney tests.

Results: Correlation between oral cancer incidence and demographic factors like age, sex, education and oral habits was found significant. Oral cancer incidencewith periodontal disease was found to be 61.2%.

Conclusion: Periodontitis can be considered as a risk factor for oral cancer. Patient with periodontal diseases should be monitored regularly and lifestyle modifications should be suggested to minimize oral cancer risks.

Keywords: Association, Cancer, Periodontal disease, Periodontitis, Periodontal Health, Oral cancer, Oral Habits, Oral Hygiene, Risk factors

1. INTRODUCTION

In the last decade India has merged has a rapidly growing economy with better health and life expectancy. However, such development is often associated with poor lifestyle choices like high-calorie food, Oral habits and reduce physical exercises. This has imposed an increase to non-communicable diseases like cancer. According to a recent survey in Southern India, Oral cancers occupied second among males and fifth rank in the order of occurrence among females.[1] Highest mortality rate is seen for Ovarian and breast cancer also and poor lifestyle and lack of awareness are contributing

factors towards high rise of cancer cases in India.[2]When we discuss the risk factors associated with oral cancer, tobacco use, chronic alcoholism, human papilloma virus and poor oral health has been attributed.[3] In addition to these low socioeconomic conditions, diet, health care is also contributing factors. Periodontal diseases have been associated with risk of oral cancer.

A study showed inverse relation between low socioeconomic conditions and oral cancer.[4]Association between oral hygiene and oral cancer is yet not established. Periodontal diseases have been considered as individual risk factor for oral cancer.[5] Clinical attachment loss and higher incidence of oral cancer was seen in a recent study.[6]Hoare et al. found inflammatory mediators as possible association between oral cancer and periodontitis.[7] Printz observed association of gum diseases with gastric cancers and concluded that inflammatory mediators and altered gene response are responsible for carcinogenesis.[8]

Komlos et al. suggested an established linkage between periodontal diseases and oral cancer.[9]The dysbiosis can lead to increase inflammatory load, accumulation of cytokines causing oxidative damage which is linked to increase risk of periodontal diseases and oral cancer.[10]The mechanistic evidence is related to the microbiota and altered host response at molecular level. Periodontal diseases are also associated with risk of diabetes mellitus, coronary heart diseases, respiratory diseases, adverse pregnancy outcomes. With systemic involvement lies the risk of oxidative damage on the cell's DNA and such alterations can be contributed to increased risk of oral cancer.[11]Yao et al. suggested role of inflammasomes in promoting oral squamous cell carcinoma.[12]This study showed the link between inflammatory mediators and oral cancer. Daily et al. found positive correlation periodontal diseases and Oropharyangeal cancer and parapharyangeal cancer.[13]The present study aims to determine the association between oral cancer and severity of periodontal disease.

2. METHOD

The case group comprised of patient diagnosed with oral cancer visiting tertiary hospital for treatment plan. The control group comprised of patient without oral cancer. We examined presence and severity of periodontitis in subject aged 18-70 year old. A total of 250 subjects were enrolled, 30 subjects were excluded from the study due to unwillingness to participate. A total 220 subjects were included finally in the study. Both case and control group were independently examined for periodontal status. The case group has 110 subjects diagnosed and histologically confirmed as oral squamous cell carcinoma (OSCC). The control group had 110 subjects with no present or prior history of Oral carcinoma. Inclusion criteria-case group histologically confirmed oral squamous cell carcinoma (buccal mucosa, gingiva, palate, lower lip and upper lip) independent of their sex, age and extent of the lesions. Exclusion Criteria consisted of all other cancer except OSCC. Control group comprised of cases other than OSCC, non-malignant lesion and other diseases treatment.

 Computer generated random selection was done independent of age and sex, allocation was done between March 2022 to June 2025.A validated questionnaire was designed for data collection.Oral health status was recorded according to DMF-index as per World Health Organisation (WHO).[14] Clinical parameters assessed were Silness-Löe plaque index (SLPI), bleeding on probing (BOP), the probing pocket depth (PPD) and clinical attachment loss (CAL) using Williams periodontal probe. The severity of periodontitis was also measured in accordance with 2017 classification.[15]

Informed consent was taken both verbal and written. The subjects underwent treatment atthe Department of Oral and maxillofacial Surgery in the tertiary hospital. All other treatment regimen involving conservative and periodontal disease was also carried out. The ethical approval was obtained by the Institutional ethical committee.Statistical analysis was obtained using SPSS Statistics 22 (IBM Corporation, Armonk, New York, USA) and the test performed were logistic regression,Mann–Whitney tests andchi-square tests.A p value < 0.05 was considered as statistically significant.

3. RESULTS

Prevalence of OSCC was 30% in the tongue region, 9% in gingiva, lips, palatal and cheeks had lower values. The **demographic details are given in table 1.**

Table 1: The examined socioeconomic risk factors and lifestyle habits in the case and the control groups:

Variables	Case	Control	p value
Age (%)			
Above 50	68	43	0.00
Below 50	42	67	
Gender (%)			
Male	92	83	0.01
Female	18	27	

Marital status (%)			
Single	15	25	
Married	50	41	0.00
Widow(er)	45	37	
Divorced	00	04	
Occupation (%)			
Currently working	7	6	
Unemployed	40	41	0.00
Housewife/homemaker	18	27	
Retired	42	24	
Disabled	2	2	
Student	1	0	
Education (%)			
Elementary school	71	73	0.03
Secondary school	24	28	
High school	15	9	
Income (%)			
High	8	7	0.16
Middle	29	32	
Low	73	72	
Smoking habit (%)			
Current smoker	48	44	
Has not smoked for Less than a year	12	07	0.17
Has not smoked for More than a year	32	17	
Never	10	32	
Alcohol consumption (%)			
Daily	20	26	0.04
Weekly	22	16	
Monthly	23	30	
Never	25	18	

Development of Oral carcinoma and gender of the patient had a significant correlation of p=0.007. Positive correlation was found between oral carcinoma and educational level. An inverse relationship for associated between education and oral carcinoma development. Table 2 illustrates oral health status.

Table 2: Comparison of the oral status in the case and in the control group

Variable	case	control	p value
Periodontal stage (%)			
I	2	4	0.00
II	3	4	
III	9	11	
IV	96	95	

CAL (mm)	5.8 ± 1.7	3.4 ± 1.2	0.00
PPD (mm)	5.4 ± 1.5	2.3 ± 1.3	0.00
BOP (%)	43.5 ± 28.7	29.7 ± 21.6	0.00
SLPI	2.3 ± 0.4	1.8 ± 0.5	0.08
DMFT index	22.45 ± 7.32	15.34 ± 9.45	0.00

Case group had more edentulous patient compared to control group. DMFT mean scores in the case group was 22.45 ± 7.32 and the control group was 15.34 ± 9.45. The incidence of oral carcinoma and periodontitis showed positive correlation. Periodontitis was seen in 62.25% of patient and incidence of oral carcinoma was seen only in 27.3% among patients without periodontal disease. Severity of periodontal disease and oral carcinoma showed significant correlation. Stage IV periodontitis was seen in 82.3% in the case group and 48.3% had stage II periodontitis in the control group. Higher level of periodontal disease was associated with incidence of oral carcinoma. Silness-Löe plaque Index,Clinical attachment loss (CAL) and probing pocket depth (PPD) showed significant difference between the two groups. BOP showed no significant difference between the groups. Logistic regression analysis showed that periodontitis was an individual risk factor for Oral carcinoma development in table 3.

Table 3: The oral health status and oral habits

	Smoking			
Alcohol consumption **Daily**	Current smoker	Has not smoked for less than a year	Has not smoked for more than a year	Never
Stage	2.1 ± 0.8	-	4.2 ± 0.0	4.0 ± 2.3
BOP	41.7 ± 21.7	-	74.3 ± 21.8	24.5 ± 32.13
SLPI	3.6 ± 0.7	-	3.2 ± 0.0	1.4 ± 1.4
DMFT	21.3 ± 8.3	24.6 ± 1.2	23.6 ± 4.3	8.3 ± 10.3
Weekly				
Stage	2.2 ± 1.6	2.6 ± 2.5	3.4 ± 0.7	2.7 ± 1.3
BOP	34.3 ± 24.9	25.2 ± 13.2	36.0 ± 17.4	27.2 ± 24.0
SLPI	2.7 ± 0.3	2.7 ± 0.7	2.3 ± 0.3	1.7 ± 1.0
DMFT	20.7 ± 10.5	20.8 ± 5.2	17.2 ± 9.3	12.6 ± 9.6
Monthly				
Stage	2.3 ± 1.7	4.7 ± 2.8	3.0 ± 0.3	-
BOP	35.7 ± 13.5	29.5 ± 34.3	6.4 ± 3.5	27.5 ± 22.8
SLPI	1.7 ± 0.5	2.7 ± 1.3	1.7 ± 0.3	1.4 ± 1.4
DMFT	13.4 ± 6.6	17.8 ± 7.3	15.7 ± 5.2	10.4± 7.3
Never				
Stage	3.3 ± 1.3	4.7 ± 1.7	2.3 ± 1.7	3.7 ± 0.6
BOP	32.6 ± 24.3	34.7± 21.3	31.7 ± 26.3	41.3 ± 28.7
SLPI	1.9 ± 0.3	1.7 ± 1.4	1.4 ± 1.3	2.3 ± 0.7
DMFT	15.7 ± 6.3	17.3 ± 3.7	20.8 ± 9.7	17.2 ± 8.3

4. DISCUSSION

Poor oral hygiene and risk of development of oral carcinoma has been examined in various studies.[16-25]Periodontitis is a polymicrobial inflammatory disease affecting periodontium and supporting tooth structure.[26] Inflammatory cytokines are increased in periodontitis causing oxidative stress and dysbiosis.[27]Periodontal pathogens and development of oral carcinoma has a linkage and carcinogenesis can be initiated by the dysbioticmicroflora associated with periodontal diseases.[28]In the present study we found significant correlation between the incidence of oral carcinoma and periodontitis.Pai et al. found positive correlation between oral cancer and periodontitis and early oral health assessment can reduce the chances of oral carcinoma development.[29]

Farhad et al. also suggested role of periodontal disease and its link with oral cancer.[30] Periodontal diseases require surgical and non-surgical management, with procedures like flap surgery to gingival recession coverage, early diagnosis and treatment can reduce microbial load and oral carcinoma development.[31-35] Minimal invasive periodontal treatment planning is preferred by patient as it has increased compliance and non-surgical treatment planning also needs oral hygiene reinforcement in post treatment planning.[36-39]

Our study support the hypothesis that severity of periodontal diseases, oral microbiota responsible for OSCC. Lee et al. found that the fungal and bacterial responsible for periodontal inflammation and oral carcinoma.[40]The mechanistic action for linkage between periodontitis and oral carcinoma lieson the microbiota, dysbiosis and programmed death receptor (PD-)1.[41]

Socioeconomic factors like income status has influence the incidence of oral cancer. In our present study, we found positive correlation between income and oral cancer incidence. This can be related to poor oral habits associated with low socioeconomic status. We need to educate subjects regarding potential harmful effects of poor oral habits and increase risk of oral cancer.

Incidence of OSCC and low education was seen positive association in the present study. This could be associated with the lack of awareness regarding oral hygiene leading to poor oral health. Poor plaque index was seen in case group compared to control group. Periodontal health status maintenance and regular dental visits can minimize microbial load and reduce chances of oral carcinoma. Age and gender were positively associated with development of oral carcinoma.Limitation of the present was no qualitative microbial evaluation and single center study.

5. CONCLUSION

Our study supports the hypothesis of severity of periodontitis as individual risk factor for oral carcinoma. Oral health maintenance can reduce the inflammatory load, cytokines and reduce the risk of OSCC. Regular dental visits, early diagnosis and treatment, improving lifestyle and habits can help in minimizing the risk of Oral carcinoma.

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 Availability of data and materials

 The datasets used and/or analysed during the current study are available from the corresponding author) on reasonable request.

Declarations

Ethics approval and consent to participate

 The necessary ethical approval for our study has been consented by Institutional Ethics and Research Committee .Participants gave written informed consent to participate.

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