

Correlation of Oral Health Status with Chronic Obstructive Pulmonary Disease in a Tertiary Care Hospital

Nandita Shenoy¹, Alisha Ono Idris², Vishak Acharya³, Junaid Ahmed⁴, Ashok Shenoy⁵, Suchitra Shenoy⁶

¹Associate Professor, Department of Oral Medicine and Radiology, ²Post Graduate, Department of Prosthodontics, Manipal College of Dental Sciences, Mangalore-575001. Affiliated to Manipal Academy of Higher Education, Manipal. Karnataka- 576104, India, ³Professor, Department of Pulmonary Medicine, ⁴Professor, Department of Oral Medicine and Radiology, ⁵Professor, Department of Pharmacology, ⁶Professor, Department of Microbiology, Kasturba Medical College, Mangalore-575001. Affiliated to Manipal Academy of Higher Education, Manipal Karnataka- 576104, India

Abstract

Background: Oral health is considered to be an important factor in respiratory diseases like Pneumonia and chronic obstructive pulmonary disease (COPD). Poor oral health and abusive habits like smoking have been implicated as an independent risk factor for the development of COPD, but few studies have evaluated the association between oral health and COPD.

Aim: To assess the oral health and habits of COPD individuals visiting our OPD for their regular checkups.

Subjects and Methods: We performed a case-control study of oral health among patients with COPD exacerbators and healthy non COPD controls. Cases had experienced ≥ 1 exacerbation in the previous 12 months, while controls were healthy patients reporting to the dental OPD for a regular dental checkup. We evaluated oral health status, recorded dental symptoms/habits, and Pulmonary Function Test (PFT). In a subset, we performed blinded dental exams to measure bleeding on probing, probing depth, clinical attachment loss, periodontitis severity, plaque index, gingival index, and carries risk. We evaluated associations between oral health and COPD using logistic regression.

Result: Self-reported oral health status and objective dental findings had variations between cases and controls. Participants with COPD had multiple missing teeth, a higher amount of plaque, and calculus indicating poor dental health. Oral candidiasis, keratotic white lesions, and oral melanosis were also present.

Conclusion: In the present observational study, we found that participants with COPD have poor oral health that compromised their quality of life probably precipitating an acute exacerbation. The incidence of COPD can be reduced by good oral hygiene measures and preventive oral care.

Keywords: COPD, Oral Health, Oral Hygiene, Chronic Periodontitis, Candidiasis

Corresponding Author:

Dr. Ashok Shenoy,

Professor, Department of Pharmacology, Kasturba Medical College, Mangalore-575001. Affiliated to Manipal Academy of Higher Education, Manipal Karnataka- 576104, India Mobile: 9880530703, Fax: 0824-2422271

Introduction

The mortality status of Chronic Obstructive Pulmonary Disease (COPD) in India is showing an alarming growth as mentioned in the WHO Global Infobase and is estimated to be approximately 556,000

out of a world total of 2,748,000 cases annually^{1,2}. The Global Initiative for Obstructive Lung Diseases (GOLD)³ defined COPD as a “preventable and treatable disease with some significant extra-pulmonary effects that may contribute to the severity in individual patients. The pulmonary component is characterized by airflow limitation, which is not fully reversible. The airflow limitation is usually progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases, such as cigarette smoke⁴.

The new concept on the pathogenesis of COPD believes that interactions between multiple environmental exposures and genetic factors determine lung function and COPD risk. It also states that impaired lung function growth in early life associated with a decline in lung function in adulthood induces COPD⁵. COPD has been strongly associated with smoking and is clinically characterized by symptoms like cough, sputum production, and/or dyspnea.^{6,7}

The therapeutic line focuses on reducing the symptoms and preventing exacerbations of the disease. Bronchodilators are the mainstay which includes β_2 -agonists and anticholinergics, either used alone or in combination with corticosteroids.⁸

Smoking tobacco is an important risk factor for the development of COPD, also oral changes associated with tobacco consumption are well known. Research associates tobacco as a major etiologic factor for potentially malignant disorders and periodontal diseases⁹.

COPD and its associated chronic morbidity and mortality in our country have led to a big burden and a huge impact on health care. More than half of COPD exacerbations are attributed to bacterial infections and recent studies have demonstrated increased microbial load and microbial diversity in COPD patients compared to healthy adults. The oral

and nasal bacteria have been identified in the lung tissue of COPD patients suggesting aspiration of oral secretions as the major cause for this disease. These findings highlight the potential impact of oral health in patients with COPD and the role of oral lesions in acute exacerbations.¹⁰

The present study was carried out to investigate the oral health condition in terms of gingival inflammation, periodontal disease, and tooth loss in subjects with a confirmed diagnosis of COPD and for comparison, a control group of healthy individuals with a history of smoking was included.

Subjects and Methods

The present study was a cross-sectional observational study carried out in the departments of Oral Medicine and Radiology at Manipal College of Dental Sciences, Mangalore in association with Kasturba Medical College Hospital, Mangalore, Karnataka. The study protocol was approved by the Institutional Ethics Committee of the institute. Before enrollment, informed written consent was obtained from each subject.

Subjects in the age group of 40 to 70 years, were selected from the outpatient and inpatient departments of the institution. 30 subjects in each group are described as follows. There were more males than females in the study group and hence we had to select a similar control group.

Group: 1

Healthy smokers who served as control. They were smokers with no history of respiratory illnesses.

Group: 2

Subjects with COPD who have been smoking for the last 10 years with a minimum of 1 pack per day [10 cigarettes} and suffering from COPD.

The diagnosis and staging of COPD were done by Pulmonary Function Tests (PFTs) using GOLD criteria³

Assessment of Lung Function:

Lung functions - vital capacity (VC), forced vital capacity (FVC), forced expiratory volume in one second (FEV_1), residual volume, and total lung capacity (TLC), was measured and chest images were obtained by Computed Tomography technique and verified by the senior pulmonologists in consensus for the diagnosis of COPD.

Oral Examination:

The COPD subjects and control groups were examined in the Department of Oral Medicine using a mouth mirror, gauze, and universal periodontal probe. Lesions were recorded in the case record form, custom-made for the study. The dentists were blinded to the case-control status of the participants. Assessments included periodontitis severity, bleeding on probing (BOP), gingival index (GI). Periodontitis severity (mild, moderate, and severe) was determined by probing depth (PD, scored as ≤ 3 , >3 to <5 , ≥ 5 to <7 , and $7+$ mm) and clinical attachment loss (CAL, scored

as <1 , 1 to 2, or $5+$ mm) based on the involvement of at least 30% of the entire dentition. Pocket depth was measured with a millimeter graduated probe at four sites per tooth and a mean value was calculated based on all remaining teeth, third molars excluded. A mean pocket depth of 4 mm was taken as a cutoff point to define periodontitis. Missing teeth and other soft tissue lesions were recorded as significant findings in these cases.

Statistical Analysis

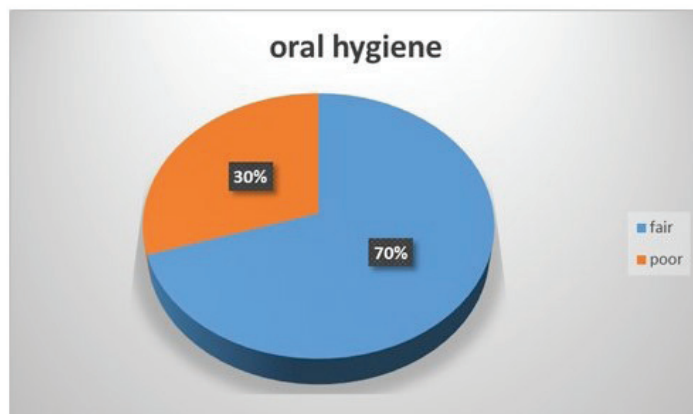
We used Chi-square tests for categorical variables and two-sample t-tests for continuous variables to test the differences in demographic and clinical characteristics between cases and controls.

Results

Oral Health status

Both COPD participants and controls had similar teeth brushing habits, with both groups participants brushing once daily. Oral health status, in general, appeared neglected and there were ample dental deposits that induced early gingival bleeding, and pocket depth was found to be increased in the study group when compared with the control group (Figure 1).

Figure 1: Oral Hygiene status of patients with COPD



The number of missing teeth was high in the COPD group as compared to the control group. Dental deposits were significantly more prevalent in the cases group when controlled for age and gender. The number of sites exhibiting gingival bleeding and pocket depth was elevated in the COPD group when compared to subjects without COPD. The mean number of remaining teeth was significantly reduced in COPD patients when compared with non-smokers and subjects without COPD controlling for age and gender.

The duration of illness varied in our study group members, ranging from a month to 15 years as and the frequency of acute exacerbations of the disease was recorded as seen in Table 1. The oral mucosal and hard tissue changes were relatively more in patients with COPD than in normal healthy subjects Table 2. In terms of periodontal health, these patients were compromised and a few of our subjects also reported burning sensation and intolerance to spicy food due to oral candidiasis.

Table 1- Baseline characteristics by COPD cases

Age Range Category	No of subjects	Valid Percent
40-50 years	4	13.3
51-60 years	6	20
61-70 years	11	36.7
71-80 years	6	20
>=81 years	3	10
Total	30	100
	Marital status	Valid Percent
Married	29	96.7
Single	1	3.3
Total	30	100
	Occupation	Valid Percent
Agriculture	3	10
Clothings	1	3.3
Coolie	1	3.3
Driver	1	3.3
Iron industry	1	3.3
Service	2	6.7
Unemployed	21	70
Total	30	100
	Educational status	Valid Percent
Degree	2	6.7
Primary	15	50
Secondary	7	23.3
Uneducated	6	20
Total	30	100

Table 2 – Oral health status of patients with COPD

	Oral hygiene	Valid Percent
Fair	21	70
Poor	9	30
Total	30	100
	Dentition status	Valid Percent
Dentate	2	6.7
Partially dentate	28	93.3
Total	30	100
	Mobility	Valid Percent
Absent	21	70
Present	9	30
Total	30	100
	Gingival bleeding	Valid Percent
Absent	1	3.3
Present	29	96.7
Total	30	100
	Presence of Calculus	Valid Percent
Absent	8	26.7
1+	16	53.3
2+	4	13.3
3+	2	6.7
Total	30	100
	STAIN	Valid Percent
Absent	15	50
1+	10	33.3
2+	4	13.3
3+	1	3.3
Total	30	100
	Hyperpigmentation	Valid Percent
Absent	23	76.7
Present	7	23.3
Total	30	100

	Salivation	Valid Percent
Increased	1	3.3
Normal	28	93.3
Reduced	1	3.3
Total	30	100
	Burning sensation	Valid Percent
Absent	29	96.7
Present	1	3.3
Total	30	100
	Oral candidiasis	Valid Percent
Absent	29	96.7
Present	1	3.3
Total	30	100
	Keratotic lesion	Valid Percent
Absent	28	93.3
Present	2	6.7
Total	30	100

Discussion

The mouth is the mirror of systemic health and the primary indicator of ill health. We aimed to determine if COPD status is associated with oral health as we are aware that the oral cavity harbors a lot of commensals, aerobic, and anaerobic potential respiratory pathogens like methicillin-resistant *Staphylococcus aureus* (MRSA) and *Pseudomonas aeruginosa*^{10,11}

Our study had the maximum number of cases in the age group of 61-70 years. This concurs with various other studies which also had a similar study group with a maximum number of cases were in the age group of 55-65 years.¹²⁻¹⁴

In our study, we also observed that the incidence of COPD was higher in males than females and this finding also coincides with other studies where they had around 80-93% males recruited in their study^{15,16} Pulmonary function tests were performed and we had recruited only cases with a conclusive diagnosis of COPD.

Dental plaque was significantly more prevalent in the study group than controls when matched with age and gender ($p < 0.01$) and this significant finding explains the number of sites exhibiting gingival bleeding, recession, and increased pocket depth in this population with COPD. The mean number of remaining teeth was significantly reduced in COPD compared with controls without COPD when matched

for age and gender.

Studies suggest a causal link between poor oral health and pulmonary disease as oral pathogens that harbor the gingival crevices can get aspirated into the pulmonary tissues which cause respiratory illness, mainly pneumonia, and COPD. In patients with neglected oral care, the composition of the oropharyngeal flora becomes heavily colonized by virulent gram-negative pathogens that have the potential to cause respiratory infections. In a few prospective controlled trials, when the sputum of patients with COPD was analyzed, the antibody levels against *Fusobacterium nucleatum* and *Prevotella intermedia* were elevated.¹⁷ These are the anaerobic organisms that have been found in patients with chronic periodontitis. Studies have proved that the microbiome of the lungs resembles the oral microbiome and the chronic microaspiration of saliva also plays a role.^{18,19} It is proved that saliva carries pathogenic bacteria, such as *Haemophilus influenza* from diseased teeth which worsens respiratory symptoms when aspirated.²⁰

A study conducted by Kucukcoskun et al.²¹ clearly showed that regular periodontal treatment significantly reduced the frequency of COPD exacerbations. A partially edentulous state was more prevalent in the COPD group compared to the non COPD groups after matching for age. This can be explained by the fact that oral hygiene gets partially neglected among patients with systemic disease and also periodontal disease progresses faster among smokers than in patients with no habit history. Wang et al.²² also found fewer remaining teeth in patients with COPD than in a control group.

Tobacco used in any form induces oral mucosal changes in the form of which intra-oral mucosal pigmentation is a known fact and that explains the oral pigmentation that was seen in our COPD group. Various studies have stated that the heat generated

during smoking triggers the melanocyte activity responsible for pigment changes in the oral cavity²³. Labial mucosa showed a high degree of pigmentation followed by the buccal mucosa in our study.

Nonscrapable white lesions in the form of keratotic patches are common on the lips at the site of habitual cigarette smoking and were appreciated in our study group. This is more visible in people who have a habit of retaining cigarettes or cigars on their lips for lengthy periods. These lesions were appreciated on the mucosal surface of the lower and upper lips at the site at which the cigarette bud is held. They were flat or slightly elevated whitish areas with red striations and can be classified as benign with no premalignant potential. Similar findings were reported in other studies among smokers and cannot be correlated with the presence or absence of COPD²⁴

Inhalational Corticosteroids (ICS) are prescribed as the mainstay of treatment in COPD and are usually administered in combination with long-acting β_2 -agonists especially in patients with severe airflow limitation²⁴⁻²⁵. Recent studies have further shown that ICS is being prescribed in COPD even more widely and frequently than expected, particularly among patients with reduced severity²⁶⁻²⁷. Oral candidiasis is a well-documented local side-effect associated with corticosteroids and is known to reduce local immune response which promotes the growth of oral *Candida*²⁸. Candidiasis induces temporary symptoms like burning sensation in the oral cavity and intolerance to spicy food which can be clinically significant and may affect patient quality of life and therapy adherence²⁹⁻³¹.

In the present study, the oral changes among patients with COPD were compared with subjects who were smokers but without a history or any apparent clinical signs & symptoms of COPD. We found that participants with COPD have poor dental hygiene practices and compromised oral health.

These oral changes could have been due to factors like age, gender, habit associated, or because of COPD condition itself. It is well documented that there is a positive relationship between aging and oral mucosa diseases and acts as a confounding factor as we had few elderly in our study group³²

Conclusion

We conclude that there is an intense diversity in the pathogenesis of COPD, its association with smoking, and its oral manifestations. We theorize that the oral microbiota and oral inflammation play key roles in this relationship between dentition status and COPD and oral flora is a major source of the lung microbiota.

The cumulative evidence of our study suggests an association between oral and pulmonary disease and the incidence of the latter can be reduced by good and regular oral hygiene measures. Smaller sample sizes and single-center observational studies are limitations of the study and daily respiratory symptom data or change in symptoms during an exacerbation were not documented. These findings will need to be corroborated in larger study groups, but they do support the idea of potentially targeting oral health to improve COPD outcomes in future days.

Ethical Clearance- Taken from Institutional Ethics committee of MCODS, Mangalore

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Conflict of Interest -nil.

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