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Dr. Snover Amin
MDS, Department of Periodontics and Implantology, Maharishi Markandeshwar University, Ambala, Haryana, India

Dr. Moin Banday
BDS, Institute of Dental Sciences, Sehora, Jammu, Jammu and Kashmir, India

Dr. Amit Kumar Khajuria
Registrar, Govt Medical College, Rajouri, Jammu and Kashmir, India

Corresponding Author:
Dr. Amit Kumar Khajuria
Registrar, Govt Medical College, Rajouri, Jammu and Kashmir, India

A cross-sectional study of the relationship between respiratory disease and periodontal disease in hospitalized patients

Dr. Snover Amin, Dr. Moin Banday and Dr. Amit Kumar Khajuria

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Abstract
Background: Periodontal infection has been linked to the worsening of systemic disorders, including lung disease, according to new research. Aspiration of microorganisms from the oropharynx into the lower respiratory tract is involved in respiratory infections such as pneumonia and the worsening of chronic obstructive pulmonary disease.
Methods: The study included 100 cases (hospitalised patients with respiratory disease) and 100 age-, sex-, and race-matched outpatient controls (systemically healthy people from the outpatient clinic of the Department of Periodontics, Maharishi Markandashwer University, Ambala, India). The gingival index (GI), plaque index (PI), and simplified oral hygiene index were among the standardized oral health metrics that were used and compared (OHI). At four places per tooth, data on probing depths and clinical attachment levels (CALs) were collected and statistically compared. For statistical analysis, the x2 and Student t tests were utilized.
Results: There were no significant variations between groups when study-population demographics were compared on the basis of age, sex, education, and income. When compared to controls, patients with respiratory disease had significantly worse periodontal health (OHI and PI), gingival inflammation (GI), larger pockets, and CALs. Patients with a low income were 4.4 times more likely than those with a high income to have periodontal disease in the case group. When compared to non-smokers in the control group, smokers had considerably greater CALs.
Conclusion: The current study's findings point to a link between respiratory and periodontal disease.

Keywords: Association, oral health, periodontal disease, respiratory disease

Introduction
Periodontal medicine, as a new branch or arm of periodontology, has pushed medicine and dentistry closer together. Periodontal infection has been linked to a variety of systemic disorders, including lung disease, according to research [1-5]. Aspiration of microorganisms from the oropharynx into the lower respiratory tract causes respiratory infections such as pneumonia and the worsening of chronic obstructive pulmonary disease (COPD). When the host's defensive systems fail to clear pathogens from the mucosal surface, the pathogens multiply, which can lead to infection and tissue loss [6-8]. Dental plaque has been identified as a possible reservoir for respiratory infections, particularly in high-risk patients with poor oral hygiene. Oral colonization by these bacteria appears to be more common in institutionalized patients than in ambulatory, non-institutionalized patients [9, 10].
Lower respiratory infections are caused by germs in aerosolized droplets or aspiration of oral secretions with microorganisms contaminating the lower airway epithelium. However, not everyone is at risk for a lower respiratory infection [11]. The use of mechanical cleansing and/or oral antiseptic rinses, such as betadine or chlorhexidine gluconate, significantly reduced the risk of lower respiratory tract infection in institutionalised patients, according to results from three preliminary intervention trials [12, 13].
In current society, pulmonary illnesses are very common. The related pain and suffering are severe; because they are chronic, the societal cost and burden on the health-care system are immense. Improved oral hygiene and regular professional oral health care have been shown to prevent the progression or onset of respiratory disorders [14].

If periodontitis increases the risk of respiratory disease, dentistry in general, and periodontology in particular, play important roles in overall prevention. As a result, this study was designed and carried out with the goal of proving the link between respiratory and periodontal disease in Indian subcontinent populations.

Materials and Methods

A group of 100 patients was chosen from the Institute of Chest Disease Maharishi Markandeshwar University, Ambala, India, who were hospitalized with respiratory disease. Similarly, 100 age-, sex-, and race-matched controls (new patients at the Department of Periodontics' outpatient clinic) were chosen. Patients' written consent was obtained after receiving institutional and ethics board approval. During the study time in the hospital, all hospital records relevant to each patient were screened. The inclusion and exclusion criteria were established, and cases and controls were chosen using systematic random selection. The research took place from August through November of 2021.

Criteria for inclusion were patients with acute respiratory disease (i.e., pneumonia, acute bronchitis, or a lung abscess) or an exacerbation of chronic respiratory disease (i.e., COPD, which included chronic bronchitis and emphysema) were considered potential cases; Patients with no past or present history of respiratory disease were considered potential controls; and Patients who were aged 20 to 60 years old and had fewer than 20 natural teeth were considered potential controls.

Criteria for exclusion were patients having a history of systemic disorders (e.g., diabetes mellitus) other than respiratory disease; Patients using any drug that could affect periodontal tissues; Patients who had received any periodontal therapy in the previous 6 months; and Patients in the Intensive Care Unit.

The gingival index (GI) of Loe and Silness [15], the plaque index (PI) of Silness and Loe [16], and the simplified oral hygiene index (OHI) of Greene and Vermillion were used as standardized measurements of oral health [17]. The clinical attachment level (CAL) was calculated by subtracting the distance between the FGM and the cement-enamel junction, which served as a reference point for each tooth, from the distance between the FGM and the bottom of the sulcus. On the disto-facial, facial, mesiofacial, and lingual surfaces, measurements of probing depth (PD) and CAL were taken at four sites per tooth, which were averaged for all sites within the patient and then across groups.

In terms of study-population demographics and periodontal parameters, the Student t and x2 tests, as well as contingency-table analysis, were utilized to analyze imbalances in diseased (cases) and non-diseased (controls) individuals. The smoking status of the participants was taken into account while comparing periodontal markers. The link between income and periodontal health was investigated as well. $P< 0.0012$ was chosen as the level of significance.

Results

There were no statistical differences in any of the demographic factors across groups (Table 1). 72 percent of patients in the case group had COPD (48 males and 24 females), 17 percent had pneumonia (nine males and eight females), and 11 percent had a lung abscess (eight males and three females). Patients with respiratory disease had significantly higher mean GI, PI, and OHI values than the control group: Respiratory illness was linked to deeper PDs and greater CALs: (Table 2).

The mean CAL value for smokers in the non-respiratory disease group was substantially greater than non-smokers, whereas the mean CAL values in the case group were statistically indifferent (Table 3).

Table 1: Study-Population Demographics

Variables	Cases (n=100)	Controls (n=100)
Age groups(yrs)		
20-30	6	8
31-40	12	19
41-50	29	25
51-60	53	48
Gender		
Males	62	60
Females	38	40
Smoking		
Smokers	38	19
Non smokers	62	81

Table 2: Comparison of Periodontal Parameters Between Groups

Parameters	Cases	Controls
GI		
Mean	1.798	1.221
SD	0.398	0.623
PI		
Mean	1.819	1.275
SD	0.384	0.194
OHI		
Mean	3.876	2.813
SD	0.629	0.534
PD		
Mean	2.229	1.684
SD	0.604	0.421
CAL		
Mean	3.132	2.432
SD	0.531	0.521

Table 3: CAL Comparison of Smokers and Non-Smokers

Patients	Subjects	CAL(mean)	CAL(SD)	P
With respiratory disease				
Smokers	38	3.162	0.494	0.702
Non-smokers	62	3.118	0.614	
With no respiratory disease				
Smokers	19	3.154	0.320	0.001
Non-smokers	81	2.453	0.512	

Discussion

The contamination of the lower airway epithelium by microorganisms contained in aerosolized droplets or aspiration of oral secretions containing bacteria starts a lower respiratory infection [18]. The frequency of pulmonary infections, particularly nosocomial pneumonia episodes in high-risk patients, appears to be influenced by oral bacteria, poor oral hygiene, and periodontitis [19]. This hypothesis has only been tested in a few studies [2]. These preliminary findings were positive and support the idea as a whole, but they clearly emphasized the need for more research.

In contrast to the findings of Scannapieco and Ho [20], who showed no significant link between gingival bleeding alone and respiratory disease, the authors of this study discovered significantly higher mean GI scores in the case group. Scannapieco *et al.* [5] and Russell *et al.* [14] both found significantly higher mean PI values in the respiratory illness group. 3 Scannapieco *et al*., [1] Garcia *et al*., [21] and Hayes *et al.* [2] found that higher mean OHI, mean PD, and mean CAL

values were linked with respiratory illness.

The current investigation could have been hampered in a number of ways. Shared risk factors, such as smoking, which is the major cause of periodontitis, emphysema, chronic bronchitis, and lung infections, may have muddled the relationship between periodontitis and respiratory disorders. Tobacco smoking inhibits phagocytosis and the death of germs by neutrophils by suppressing the synthesis of protective immunoglobulin G2 antibodies [22]. Tobacco smoking also inhibits lung clearance and paralyzes ciliary function, increasing the risk of respiratory illness by more than fourfold. Furthermore, because the current study was cross-sectional, a definitive cause-and-effect association between poor periodontal health and the development of respiratory disease could not be established.

However, given the intricacy and multivariate nature of respiratory disease, a dosage effect for the link between periodontitis and respiratory disease is unlikely to be demonstrated. As a result, plaque buildup or periodontal disease does not induce respiratory or other systemic disorders directly. In fact, in susceptible and high-risk individuals, they may worsen these systemic disorders. The importance of strict plaque control and treatment of oral infections, especially in these high-risk groups, is well established.

Conclusion

The current study's findings support a possible link between periodontal disease and respiratory disease, demonstrating a positive link between poor periodontal health and the chance of acquiring respiratory disease. Dentists, particularly periodontists, may be able to help avoid respiratory disease by redoubling their efforts to prevent periodontitis and stop the advancement of periodontitis in patients who currently have it. As a result, in addition to an assessment of the elements that contribute to the associated risk, the patient should be educated about the risk and, if necessary, appropriate intervention techniques undertaken. Prospective longitudinal studies comparing respiratory disease rates in institutionalized patients with and without periodontal disease, as well as interventional studies evaluating the effect of periodontal therapy on the incidence of respiratory disease in these patients, are among the studies to be conducted.

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