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Article

Impact of Chronic Obstructive Pulmonary Disease on Oral Health: A Cross-Sectional Study at the University Hospital Center of Sidi Bel Abbès, Algeria

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Abstract

Introduction: Chronic Obstructive Pulmonary Disease (COPD), a respiratory pathology primarily linked to smoking, appears to exacerbate oral health problems through systemic and local mechanisms. This study evaluates the impact of COPD on the oral health of smoking patients in an Algerian context. **Methods:** A descriptive cross-sectional study was conducted from January to June 2023 at the University Hospital Center of Sidi Bel Abbès, Algeria. A total of 138 male smoking patients were included. Each participant answered a standardized questionnaire, underwent a thorough clinical oral examination, and spirometry to confirm the diagnosis of COPD ($FEV_1/FVC < 0.7$ post-bronchodilator). **Results:** Out of 138 patients, 62 (44.9%) had confirmed COPD. Tooth loss was significantly more frequent among COPD patients (88.7%) than among non-COPD patients (77.6%, $p = 0.03$). Dental caries were also more prevalent in the COPD group (85.5%) compared to the non-COPD group (70.1%, $p = 0.02$). Gum disease (93.5% vs. 91.3%, $p = 0.65$) and bad breath (79.0% vs. 76.0%, $p = 0.70$) showed similar prevalences in both groups. **Conclusion:** COPD is associated with a significant deterioration of oral health, particularly regarding tooth loss and dental caries. A multidisciplinary management approach involving pulmonologists and dentists is crucial to improve clinical outcomes and patient quality of life.

Keywords: chronic obstructive pulmonary disease; oral health; smoking; dental caries; periodontal disease; systemic inflammation

1. Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a chronic respiratory illness characterized by irreversible airway obstruction, primarily caused by prolonged exposure to tobacco smoke [1]. With a global prevalence estimated at 10-12% among adults over 40 years old, COPD represents a major cause of morbidity and mortality, particularly in developing countries such as Algeria [2,3]. Smoking, the main etiological factor for COPD, is also a well-documented risk factor for oral health pathologies, including periodontal diseases, dental caries, and tooth loss [4,5].

Recent studies suggest that COPD could worsen oral health problems through systemic and local mechanisms. The chronic inflammation associated with COPD, characterized by high levels of pro-inflammatory cytokines (e.g., IL-6, TNF- α), could exacerbate periodontal pathological processes [6,7]. Furthermore, altered salivary function, often observed in COPD patients due to

medications like anticholinergics or inhaled corticosteroids, can increase susceptibility to caries and oral infections [8]. Disease-related behaviors, such as neglected oral hygiene due to dyspnea (shortness of breath), might also play a role [9].

While studies have highlighted a link between COPD and oral health, data remain limited, particularly in populations characterized by pronounced smoking habits, insufficient oral hygiene practices, and restricted access to dental care.

This study aims to evaluate the impact of COPD on the oral status of smoking patients followed at the University Hospital Center of Sidi Bel Abbès, Algeria, and to explore the implications for integrated management.

2. Materials and Methods

2.1. Study Design and Location

A descriptive cross-sectional study was conducted from January to December 2023 at the Clinical Physiology and Functional Explorations Department and the Dental Clinic of the Faculty of Medicine at the University Hospital Center of Sidi Bel Abbès, Algeria.

2.2. Study Population

Inclusion Criteria:

The study included male patients, aged 18 years or older, with a history of active or former smoking and a cumulative consumption of at least 5 pack-years (calculated as the number of packs of cigarettes smoked per day multiplied by the number of years of smoking). Participants had to be consulting either for respiratory symptoms such as chronic cough or dyspnea, or for routine dental follow-up or specific oral and dental complaints.

Exclusion Criteria:

Patients with systemic pathologies likely to influence oral health were excluded, notably diabetes mellitus, HIV/AIDS infection, autoimmune diseases (such as rheumatoid arthritis or systemic lupus erythematosus), or those undergoing immunosuppressive treatments (e.g., systemic corticosteroids, chemotherapy). A history of cervico-facial radiotherapy, which can alter oral tissues, as well as refusal to participate in the study, also constituted exclusion criteria.

2.3. Procedures

1- Standardized Questionnaire:

Sociodemographic Data: Age, occupation, level of education.

Smoking Habits: Duration and intensity of smoking (pack-years, calculated as [number of packs per day] × times [number of years]).

Oral Hygiene: Frequency of tooth brushing (<1, 1, ≥2 times/day), use of dental floss, annual dental consultations.

Reported Symptoms: Dry mouth, gum pain, bad breath.

2- Oral and Dental Examination: Performed by three dental surgeons. The evaluated parameters included:

Tooth Loss: Number of missing teeth (excluding orthodontic extractions).

Dental Caries: DMFT Index (Decayed, Missing, Filled Teeth), according to WHO criteria.

Gum Diseases: Evaluated via the Löe and Silness Gingival Index [10], with a score ≥1 indicating gingivitis or periodontitis.

Bad Breath (Halitosis): Standardized organoleptic evaluation (scale of 0 to 5) [11].

3-COPD Diagnosis

COPD diagnosis was confirmed by spirometry (Body Plethysmography, Medisoft Body Box 5500 DLCO type) according to GOLD criteria [1].

FEV/FVC ratio < 0.7 after the administration of 400 µg of salbutamol was diagnostic for COPD. The severity of COPD (GOLD stages I to IV) was recorded.

2.4. Statistical Analysis

Data were analyzed using SPSS version 22.0.

Continuous variables (age, pack-years) were presented as mean ± standard deviation or median (interquartile range) depending on their distribution, which was checked by the Shapiro-Wilk test.

Categorical variables (e.g., caries, tooth loss) were expressed as percentages.

Comparisons between the COPD and non-COPD groups used the Student's t-test for continuous variables and the chi-squared test (or Fisher's exact test for small samples) for categorical variables.

Multivariate logistic regression was performed to adjust the results, taking into account age, pack-years, brushing frequency, and education level.

The significance threshold was set at $p < 0.05$.

3. Results

3.1. Population Characteristics

A total of 138 male smokers were included. The mean age was 57.8 ± 9.7 years (COPD: 58.9 ± 10.1 years; non-COPD: 56; $p = 0.32$). Among them, 62 patients (44.9%) had COPD confirmed by spirometry. The demographic, smoking, and oral hygiene characteristics are summarized in Table 1.

Table 1. Demographic and smoking characteristics of participants.

Characteristics	COPD (n=62)	Non-COPD (n=76)	p-value
Mean age (years)	58,9 ± 10,1	56,9 ± 9,4	0,32
Pack-years (median, IQR)	30 (20–45)	25 (15–35)	0,04
Educational level (≤ primary, %)	61,3 %	55,3 %	0,48
Tooth brushing frequency (<1/day, %)	51,6 %	46,1 %	0,52
Dental visits (≥1/year, %)	22,6 %	28,9 %	0,39

3.2. IQR: Interquartile Range

COPD patients had a significantly higher tobacco consumption ($p = 0.04$). No notable differences were observed for age, education level, brushing frequency, or dental consultations.

3.3. Oral and Dental Status

Tooth loss was significantly more frequent in COPD patients (88.7%) than in non-COPD patients (77.6%, $p = 0.03$).

Dental caries were also more frequent in the COPD group (85.5%) compared to the non-COPD group (70.1%, $p = 0.02$).

Gum diseases (93.5% vs 91.3%, $p = 0.65$) and bad breath (halitosis) (79.0% vs 76.0%, $p = 0.70$) showed high but similar prevalences in both groups.

The results of the oral and dental examination are presented in Table 2.

Table 2. Prevalence of oral health pathologies according to the presence of COPD.

Variable	COPD (n=62)	Non-COPD (n=76)	p-Value
Tooth loss (%)	88,7 %	77,6 %	0,03
Gum diseases (%)	93,5 %	91,3 %	0,65
Dental caries (%)	85,5 %	70,1 %	0,02
Halitosis (%)	79,0 %	76,0 %	0,70

3.4. Multivariate Analysis

A multivariate logistic regression, adjusted for age, pack-years, brushing frequency, and education level, confirmed that COPD was an independent risk factor for tooth loss (OR= 2.4; IC 95%: 1.2–4.9; $p = 0.02$) and dental caries (OR = 2.2; IC 95%: 1–4.3; $p = 0.03$).

No significant association was observed for gum diseases (OR= 1.3; IC 95%: 0.4–4.1; $p = 0.67$) or bad breath (OR= 1.2; IC 95%: 0.6–2.5; $p = 0.61$).

4. Discussion

Our study highlights a significant association between Chronic Obstructive Pulmonary Disease (COPD) and a notable worsening of oral health, particularly concerning tooth loss and dental caries, within a population of Algerian smokers. These results are consistent with observations reported in the literature.

The marked prevalence of tooth loss (88.7% in patients with COPD versus 77.6% in non-COPD patients) corroborates the findings of Dietrich et al. [4], who established that chronic smoking promotes tooth loss through periodontal mechanisms.

The exacerbating effect of COPD could be explained by chronic systemic inflammation, characterized by high levels of pro-inflammatory cytokines such as IL-6 and TNF- α . These mediators amplify destructive periodontal processes and hinder tissue regeneration [6, 7].

Furthermore, the alteration of salivary function, frequently observed in COPD patients due to treatments like anticholinergics or inhaled corticosteroids, increases the susceptibility to dental caries, as highlighted by Tan et al. [8].

The high prevalence of gum diseases in both groups (93.5% for COPD and 91.3% for non-COPD) reflects the deleterious impact of smoking, independent of COPD status, in accordance with the work of Kurhańska-Flisykowska et al. [5]. This observation suggests that tobacco is a dominant risk factor for periodontal damage, potentially overshadowing the specific effect of COPD in this area.

Conversely, the absence of a significant difference for bad breath (halitosis) (79.0% in COPD patients versus 76.0% in non-COPD patients) is consistent with the observations of Rosenberg [11], who primarily attribute this symptom to local factors, such as dental plaque accumulation or oral microbiota imbalances, rather than to systemic conditions like COPD.

These results emphasize the complex interaction between COPD, smoking, and oral health. They highlight the need for targeted preventive approaches, including better awareness of oral hygiene and an integrated care strategy combining pulmonologists and dental surgeons to optimize the overall health of patients with COPD.

4.1. Pathophysiological Mechanisms

- Several mechanisms could explain the association between COPD and oral and dental diseases:
- Systemic Inflammation: COPD leads to a chronic elevation of inflammatory markers, which can amplify destructive periodontal processes and reduce tissue repair capacity [6].
 - Xerostomia (Dry Mouth): COPD treatments, such as anticholinergics and inhaled corticosteroids, are associated with reduced salivary flow, increasing the risk of dental caries and oral infections [8, 12].
 - Behavioral Factors: Chronic dyspnea (shortness of breath) and fatigue associated with COPD can lead to a neglect of oral hygiene, as observed by Koblizek et al. [13].
 - Oral Microbiota: Changes in the oral microbiota of COPD patients, potentially related to local immunosuppression, could promote periodontal infections [7].

4.2. Clinical Implications

These results underscore the need for a multidisciplinary approach to the management of COPD patients. Recommendations include:

Patient Education: Awareness campaigns on the importance of oral hygiene, particularly for smokers with COPD.

Oral Health Screening: Systematic integration of dental examinations into the follow-up of COPD patients, in collaboration with dental surgeons.

Medication Management: Evaluation of the oral side effects of medications and exploration of therapeutic alternatives if necessary.

Smoking Cessation: Strengthening smoking cessation programs, which could reduce both the progression of COPD and oral health damage.

5. Limitations

Cross-sectional Design: The study does not allow for establishing a causal link between COPD and oral and dental diseases.

Homogeneous Population: Exclusive inclusion of male patients limits the generalizability of the findings to women, who may show differences in COPD prevalence and oral hygiene practices.

Sample Size: Although sufficient to detect significant differences for tooth loss and caries, the sample remains modest for secondary analyses (e.g., bad breath).

6. Conclusions

Our study demonstrates that COPD is associated with a significant worsening of tooth loss and dental caries in smokers, likely due to systemic inflammation, salivary alteration, and behavioral factors. These results highlight the importance of a multidisciplinary management approach involving pulmonologists, dental surgeons, and public health professionals to improve the quality of life of COPD patients. Longitudinal, multicenter studies that include diverse populations (men and women, different COPD stages) are necessary to confirm these observations, elucidate the pathophysiological mechanisms, and evaluate the effectiveness of preventive interventions.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Taleb Mourad faculty of medicine Committee, Djilali Liabes University, and also reviewed by Hassani Abdelkader ethical committee (reference number 102023).

Informed Consent Statement: Informed consent was obtained from all subjects involved in this study.

Conflicts of interest: The authors declare no conflict of interest.

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