

Investigation of the Prevalence of Oral Mucositis and Associated Risk Factors in Chronic Obstructive Pulmonary Disease Patients: A Prospective Cross-Sectional Study

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Abstract

OBJECTIVE: This study was conducted to determine the prevalence of oral mucositis in chronic obstructive pulmonary disease patients and the risk factors likely to be effective in the development of oral mucositis.

MATERIAL AND METHODS: This prospective cross-sectional study was carried out with 147 patients with chronic obstructive pulmonary disease who were monitored for 7 days from their admittance to the chest diseases clinic of a university hospital between January 2021 and January 2022. Patient Information Form, Oral Assessment Guide, and World Health Organization Mucositis Grading Scale were used to obtain the study data.

RESULTS: While 81% of the patients in the study were male, the mean age was 64.6 ± 10.0 years, and the duration of chronic obstructive pulmonary disease diagnosis was 8.58 ± 6.52 years. In the study, while 61.9% of the total 147 patients monitored for 7 days had findings in favor of oral mucositis, the severity of oral mucositis and the mean total oral mucosa score of the patients were found to increase significantly in these 7 days of the monitoring period ($P < .001$). As per the logistic regression findings, the duration of chronic obstructive pulmonary disease diagnosis (95% CI 1.05-1.49; $P = .010$), the presence of medication use containing corticosteroids (95% CI 6.05-72.17; $P < .001$), and the amount of oxygen administered to the patient (95% CI 1.07-3.44; $P = .029$) were found to be significant risk factors associated with the development of oral mucositis.

CONCLUSION: The results indicate that the severity of oral mucositis has a tendency to increase in chronic obstructive pulmonary disease patients from the third day of treatment, and oral care is critically important in patients, who are with a longer diagnosis of chronic obstructive pulmonary disease, who are treated with medications containing corticosteroids and who need high-intensity oxygen therapy.

KEYWORDS: COPD, corticosteroids, oral mucositis, prevalence

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is an important respiratory system disease that develops due to insufficient airflow together with the change in lung tissue, respiratory tract, and alveolar structure, as a result of exposure to harmful particles and gases, and it has a cough, sputum, chronic and progressive dyspnea as the prominent symptoms.^{1,2}

While the prevalence of COPD, which is considered one of the most common causes of respiratory diseases characterized by chronic and irreversible airflow obstruction, varies by country, age, and gender, it is estimated to have a prevalence that corresponds to <6% of the adult population for most countries worldwide.² The prevalence of COPD, which is known to affect 16 million adults, ranges from 10.2% to 20.9% in the United States,³ whereas the average global prevalence of COPD, 1 of the 5 most common health problems of the last decade in Europe, among 19 European countries has been reported as 12.38%.⁴ Although the prevalence of COPD, which is considered a serious public health problem in Turkey similar to the rest of the world, has been reported to vary between 5% and 19%, a 35% increase has been noted in annual general prevalence rates of COPD patients diagnosed between 2012 and 2016.^{5,6}

Chronic obstructive pulmonary disease is a disease with a complex etiology, which includes multiple genetic and environmental factors such as smoking and air pollution, among its causes. However, another point that the literature draws attention to is that there is a relationship between periodontal diseases and poor oral health and the pathogenesis and exacerbation of COPD.^{7,8} Bacteria in the oral mucosa are considered a potential source of the development of lung infections due to anatomical proximity.⁹ It is a known fact that about half of COPD exacerbations may be caused by bacterial infections.^{10,11} It is also known that patients with COPD have insufficient awareness of oral health, and therefore they are prone to periodontal diseases and poor oral health.¹² Therefore, reducing the bacterial load in the oral mucosa and maintaining oral health in COPD patients have critical importance for the treatment and care of the disease. Besides, while the

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importance of oral health is considered an important factor in the etiology of COPD, it is another noteworthy point that various problems associated with the chronic disease process and treatment associated with COPD may also be risk factors for the deterioration of oral health.⁷⁻¹³

One of the most important problems disrupting the continuity of the integrity of the oral mucosa in patients with COPD is the development of oral mucositis.⁹ Oxygen therapy, which is an important part of medical treatment in COPD, the potential effects of oral or inhalation medications on suppressing the immune system and increasing dryness of mouth, and physical weakness and inadequacies associated with the disease process that prevent patients from performing daily life activities such as oral care increase the susceptibility to deterioration of oral integrity and the development of opportunistic infections.^{14,15} Therefore, identifying the conditions that contribute to the deterioration of oral health, as well as maintaining the integrity of the oral mucosa in COPD patients, have critical importance. Although there are some studies, in the literature, examining the prevalence of oral mucositis, especially among the patient groups with cancer treatment, there has been a very limited number of studies to determine the prevalence of oral mucositis and associated risk factors in COPD patients. This study, which was planned based on this need, aimed to determine the prevalence of oral mucositis in COPD patients, define the factors that are thought to be effective in the development of oral mucositis, and provide scientific data to the limited literature on this field.

MATERIAL AND METHODS

Study Design

This is a prospective cross-sectional study conducted to determine the prevalence of oral mucositis and associated risk factors in COPD patients.

Study Population and Sample Size Calculation

The study population consisted of 671 patients with a diagnosis of COPD who were admitted to the chest diseases clinic of the Health Practice and Research Center of Afyonkarahisar Health Science University between January 1, 2021, and January 1, 2022. The minimum sample size to be reached in the study was determined as 132 with a 0.05 margin of error and 80% CI, according to the formula ($n = Nt^2 pq/d^2$

$(N-1) + t^2pq$) which is used when the number of individuals in the study population is known.¹⁶ A total of 147 patients, who were 18 years of age or above, admitted with the diagnosis of COPD within the date range specified in the study, did not have communication issues and could speak and understand Turkish, were fully oriented and conscious, had no infection, wound, or oral mucositis in the mouth, and whose oral mucosa could be monitored regularly for 7 days from the first day of admittance, formed the study sample. Patients who had an infection, wound, and oral mucositis in their mouth at the time of admission to the relevant clinic, wanted to leave after being included in the study, could not communicate and could not speak or understand Turkish, were disorientated and unconscious, did not want to participate, and whose oral mucosa could not be monitored continuously, were not included in the study.

Data Collection and Data Collection Tools

Patient Information Form, World Health Organization Oral Mucositis Scoring Index (WHO-OMSI), and Oral Assessment Guide (OAG) were used as data collection tools in the study.

Patient Information Form

This form, created with the literature review^{1,7,14,15} and expert opinion, consists of a total of 22 questions aimed at obtaining patients' data on their demographic characteristics (3 questions) and medical histories (16 questions). The information in the Patient Information Form was obtained by the researchers during the face-to-face interview with the patients, conducted by applying infection control measures and checking the patient file.

World Health Organization Oral Mucositis Scoring Index

World Health Organization Oral Mucositis Scoring Index is one of the tools developed by the WHO and is often used for the assessment of the severity of oral mucositis, which leads to deterioration of oral health.¹⁷ According to the assessment criteria in this tool, stage 0 means no presence of mucositis, stage 1 refers to the presence of mild mucositis, stage 2 refers to the presence of moderate mucositis, while stage 3 and stage 4 refer to the presence of severe mucositis, in which the integrity of the oral mucosa is impaired.^{17,18} In this study, in order to assess the severity of oral mucositis in patients included in the study, WHO-OMSI was completed by the same researcher, scoring 0-4, during the 7-day monitoring period starting from the first day of admittance of the patient.

Oral Assessment Guide

Oral Assessment Guide, developed by Eilers et al¹⁹ in 1988, is a tool in which the integrity of the individual's oral mucosa and changes in the oral mucosa associated with the development of mucositis are assessed in 8 categories, macroscopically and by interviewing the patient. The tool was widely used in many oral health studies in Turkey.^{15,20,21} The validity and reliability of this measurement tool in Turkey were carried out by Çiftçioğlu and Efe²² in 2017 in the population of young and pediatric patients. With OAG, changes in the individual's voice and swallowing function, saliva, tongue, lips, mucous membrane, gingiva, teeth, or oral prostheses are scored from 1 to 3 and the total oral mucosa score is obtained. The lowest score that can be obtained from OAG, a guiding tool in planning the oral care needs of the individual,

MAIN POINTS

- Oral mucositis is a common, preventable health problem in patients with chronic obstructive pulmonary disease (COPD).
- Patients with COPD are a patient group with a high need for oral care aimed at protecting the integrity of the oral mucosa.
- In COPD patients, there was a trend toward an increased risk of impaired oral mucosal integrity from day 3 of medical therapy.
- The duration of COPD diagnosis, use of corticosteroid-containing drugs, and oxygen therapy were defined as risk factors associated with the development of oral mucositis in COPD patients.

is 8 and the highest score is 24, and a high score indicates an increase in the severity of mucositis and symptoms associated with deterioration of the integrity of the oral mucosa. In this study, OAG, used in order to evaluate the changes in the oral mucosa of the patients included in the study, was completed by the same researcher with a rating from 1 to 3 by the macroscopic examination of the oral mucosa with a light source and interviewing the patient during the 7-day monitoring period from the first day of admittance of the patient, which is the monitoring days of the study.

In the clinic where the study was conducted, the standard protocol for maintaining the oral health of the patients was rinsing the mouth with water after the use of inhalers. In addition, patients with very severe findings in favor of oral mucositis were limited to the use of a pharmacological agent at the physician's order. However, patients with oral mucositis and who had to use a pharmacological agent were not included in the study, which was consistent with the exclusion criteria of this study. During the conduct of the study, in order to ensure standardization in all patients, training was provided by the researchers on the importance of oral care and the patient's routine oral care practice.

Ethical Aspect of Study

In order to be able to conduct the study, the institutional permission (15/10/2020-E.19116) from the directors of the Health Practice and Research Center of Afyonkarahisar Health Science University and the permission of the ethics (2020/470) were obtained from the non-interventional clinical research ethics committee of the relevant university. Also, the patients included in the study were informed about the purpose of the study and their verbal and written consent was obtained.

Statistical Analysis

All statistical analyses of the data obtained in the study were performed with the Statistical Package for Social Sciences version 22.0 (IBM Corp.; Armonk, NY, USA) package program. Categorical data were shown as numbers and percentages, while continuous variables data were shown as mean and standard deviation. In the study, the Friedman test was used to analyze the dependent group comparisons of categorical variables obtained during the 7-day monitoring period and more than 2 dependent group comparisons of continuous variables that did not show normal distribution. Binary logistic regression analysis was used to determine the variables that affect the oral mucositis development risk in patients included in the study. In statistical analyses, the significance level was accepted as $P < .05$.

RESULTS

Characteristics of the Patients

When the findings related to the demographic characteristics of the patients were examined, it was founded that the mean age of the patients was 64.6 ± 10.0 years, 81% were male, and 46.9% were retirees.

Medical Characteristics of the Patients

The distribution of the findings related to the medical characteristics of the patients was presented in Table 1. As per

Table 1. Medical Characteristics of the Patients (n = 147)

| | Mean \pm SD | |
|--|-----------------------------------|----------|
| Duration of COPD Diagnosis (year) | 8.58 \pm 6.52 | |
| | (min: 1; max: 31) | |
| Presence of systemic disease | n | % |
| Yes | 97 | 66.0 |
| Type of systemic disease* (n = 97) | | |
| Diabetes | 47 | 35.3 |
| Hypertension | 65 | 48.9 |
| Coronary artery disease | 12 | 9.0 |
| Chronic renal failure | 1 | 0.8 |
| Asthma | 8 | 6.0 |
| Medications used in treatment* | | |
| Antibiotic | 146 | 24.1 |
| Mucolytic | 146 | 24.1 |
| Bronchodilator | 136 | 22.5 |
| Corticosteroid | 106 | 17.5 |
| Antihypertensive | 71 | 11.7 |
| Presence of the intermittent/continuous oxygen therapy | | |
| Yes | 147 | 100.0 |
| | Mean \pm SD | |
| The amount of oxygen in therapy (L/min) | 3.87 \pm 1.71 | |
| | (min: 2; max: 8) | |
| Smoking habits | n | % |
| Yes | 88 | 59.9 |
| Number of cigarettes smoked per day (n = 88) | | |
| less than one pack | 20 | 22.7 |
| 1-2 packs | 29 | 33.0 |
| more than two packs | 39 | 44.3 |
| Alcohol use | | |
| Yes | 13 | 8.8 |
| Dietary habits | | |
| Balanced | 119 | 81.0 |
| Irregular eating habit | 28 | 19.0 |
| The daily amount of fluid consumption | | |
| < 1500 mL | 70 | 47.6 |
| \geq 1500 mL | 77 | 52.4 |
| Presence of prosthesis in the mouth | | |
| Yes | 51 | 34.7 |
| Tooth brushing habits** (n = 96) | | |
| Yes | 21 | 21.8 |
| Frequency of daily tooth brushing | | |
| One per day | 19 | 90.5 |
| Two per day | 2 | 9.5 |
| Status of experiencing the development of oral mucositis before | | |
| Yes | 85 | 57.8 |
| The severity of previous oral mucositis (n = 85) | | |
| Mild | 34 | 40.0 |
| Middle | 38 | 44.7 |
| Severe | 13 | 15.3 |

SD, standard deviation.

*Indicates more than one option. **Indicates patients who do not have a prosthesis in the mouth.

Table 2. Oral Mucositis Grades of the Patients According to the Follow-Up Days (n = 147)

| | Day 1 | | Day 2 | | Day 3 | | Day 4 | | Day 5 | | Day 6 | | Day 7 | | |
|---|-------|-------|-------|------|-------|------|-------|------|-------|------|-------|------|-------|------|------------------------------------|
| | n | % | n | % | n | % | n | % | n | % | n | % | n | % | |
| Stage 0 (No mucositis, normal oral flora) | 147 | 100.0 | 144 | 98.0 | 109 | 74.1 | 61 | 41.5 | 48 | 32.7 | 56 | 38.1 | 56 | 38.1 | $\chi^2 = 421.485$ * $P < .001$ |
| Stage 1 (Pain, +/- erythema, no ulceration. Can be fed orally) | - | - | 3 | 2.0 | 34 | 23.1 | 68 | 46.3 | 55 | 37.4 | 43 | 29.3 | 38 | 25.9 | |
| Stage 2 (painful erythema, edema or ulcers, solid diet tolerated) | - | - | - | - | 4 | 2.7 | 18 | 12.2 | 43 | 29.3 | 44 | 29.9 | 46 | 31.3 | |
| Stage 3 (painful erythema, edema or ulcers, liquid diet only) | - | - | - | - | - | - | - | - | 1 | 0.7 | 4 | 2.7 | 7 | 4.8 | |
| Stage 4 (Presence of erythema, edema, ulcer, severe pain, bleeding. Requires parenteral and enteral nutritional support.) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |

*Friedman test.

the findings, the mean duration of COPD diagnosis in the patients was 8.58 ± 6.52 years and 66% of them had systemic disease, while hypertension (48.9%) and diabetes (35.3%) were the majority of these systemic diseases. During the treatment process, the patients were found to mostly use "antibiotic" (24.1%), "mucolytic" (24.1%), "bronchodilator" (22.5%) types of medication, and 17.5% of them were on medicine therapy containing corticosteroid. All of the patients were found to receive intermittent or continuous oxygen therapy, while the mean amount of oxygen administered during the therapy was 3.87 ± 1.71 L/min. The daily amount of fluid consumed was ≥ 1500 mL for 52.4% of the patients, whereas the majority of patients without prostheses (78.2%) did not have the habit of brushing their teeth. More than half of the patients (57.8%) reported experiencing the development of previous oral mucositis before, and 44.7% of those stated that the previous oral mucositis development was moderate (Table 1).

Characteristics of Oral Mucositis of Patients

A total of 61.9% of 147 patients monitored for 7 days were observed to have findings favoring oral mucositis, while there was no oral mucositis development in only 38.1% of the patients. The patients' findings related to the development of oral mucositis during the 7-day oral monitoring period were presented in Table 2 and Figure 1.

As per the findings, only 3 patients (2.0%) were found to have stage 1 oral mucositis on the second day of the monitoring, while 4 patients (2.7%) had stage 2 oral mucositis from the third day of the monitoring onward, in favor of disruption of the integrity of the oral mucosa. While none of the patients had stage 4 oral mucositis during the 7-day monitoring period, the rate of patients with stage 3 oral mucositis development as of the fifth day of monitoring was 0.7%, 2.7%, and 4.8%, respectively. Furthermore, the severity of oral mucositis was found to increase significantly during the 7-day monitoring period ($P < .001$; Table 2 and Figure 1).

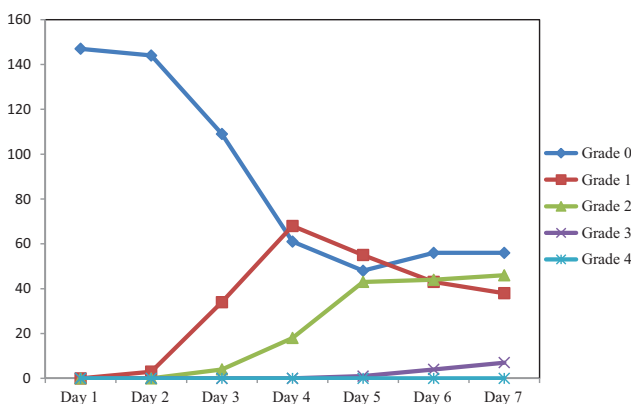


Figure 1 Observation days and the World Health Organization Oral Mucositis Scoring Index - (WHOOMS) change curve

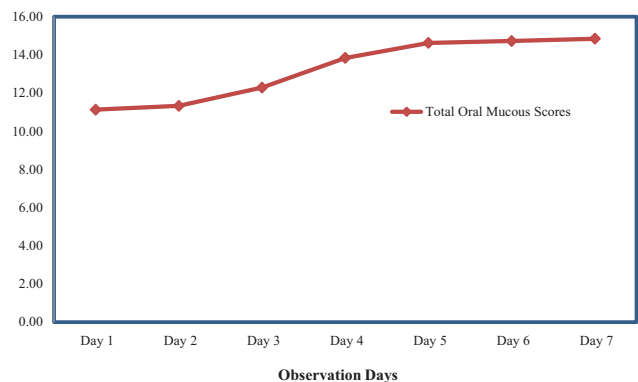


Figure 2 Total Oral Mucosa Scores change curve of the Patients According to the Follow-up Days

Table 3. Binary Logistic Regression Analysis Results Related to the Determination of Risk Factors Affecting the Oral Mucositis Development

| Variable | Beta | SE | Wald | P | OR | 95% CI | |
|--|--------|-------|--------|-----------------|--------|-------------|-------------|
| | | | | | | Lower Bound | Upper Bound |
| Age (year) | -0.006 | 0.045 | 0.017 | .896 | 0.994 | 0.911 | 1.085 |
| Duration of COPD diagnosis (year) | 0.228 | 0.088 | 6.708 | .010 | 1.256 | 1.057 | 1.492 |
| Presence of systemic disease | | | | | | | |
| Reference = [No] | | | | | | | |
| Yes | -0.090 | 0.792 | 0.013 | .910 | 0.914 | 0.194 | 4.318 |
| Use of medication containing steroid | | | | | | | |
| Reference=[No] | | | | | | | |
| Yes | 3.040 | 0.632 | 23.112 | <.001 | 20.900 | 6.052 | 72.170 |
| The amount of oxygen in therapy (lt/min) | 0.653 | 0.299 | 4.781 | .029 | 1.921 | 1.070 | 3.449 |
| Smoking habits | | | | | | | |
| Reference=[No] | | | | | | | |
| Yes | -0.396 | 0.692 | 0.327 | .567 | 0.673 | 0.174 | 2.613 |
| Tooth brushing habits | | | | | | | |
| Reference=[No] | | | | | | | |
| Yes | -0.710 | 0.970 | 0.536 | .464 | 0.491 | 0.073 | 3.292 |
| The daily amount of fluid consumption (ml) | | | | | | | |
| Reference = [≥ 1500 mL] | | | | | | | |
| < 1500 mL | 0.303 | 0.679 | 0.199 | .656 | 1.354 | 0.357 | 5.127 |
| Presence of prosthesis in the mouth | | | | | | | |
| Reference = [No] | | | | | | | |
| Yes | 0.661 | 2.302 | 0.082 | .774 | 1.936 | 0.021 | 176.404 |
| Status of experiencing the development of oral mucositis before | | | | | | | |
| Reference = [No] | | | | | | | |
| Yes | 1.205 | 0.780 | 2.385 | .123 | 3.336 | 0.723 | 15.394 |
| Constant | -3.401 | 2.673 | 1.619 | .203 | 0.033 | | |

OR, odds ratio; SE, standard error.

Cox & Snell R Square: 0.378; Nagelkerke R Square: 0.521; accuracy: 0.804.

The distribution of the total oral mucosa scores of the patients, which indicate the presence of changes in the oral mucosa associated with the development of mucositis, was presented in Figure 2. As per the findings, while the mean total oral mucosa scores of the patients were found to be similar to each other on the first (11.13 ± 1.06) and second (11.33 ± 1.11) days, it was 14.85 ± 2.78 on the seventh day. Also, the mean total oral mucosa scores of the patients were observed to increase significantly during the 7-day monitoring period ($P < .001$; Figure 2).

Risk Factors Affecting the Development of Oral Mucositis in Chronic Obstructive Pulmonary Disease Patients

In the regression model created with the independent variables included in the model, these variables were found to explain 52.1% of the model. As per the logistic regression findings, the duration of COPD diagnosis ($P = .010$), the use of medication containing corticosteroids ($P < .001$), and the amount of oxygen administered to the patient during

the oxygen therapy ($P = .029$) were found to be significant risk factors contributing to the development of oral mucositis in COPD patients. Accordingly, a 1-unit increase in the duration of COPD diagnosis leads to a 1.256 (95% CI 1.05-1.49) times increase in the risk of developing oral mucositis, while the use of medication containing corticosteroids in the treatment increases the risk of developing oral mucositis 20.900 times (95% CI 6.05-72.17). Furthermore, a 1-unit increase in the amount of oxygen administered to the patient during the treatment period was found to lead to a 1.921 (95% CI 1.07-3.44) times increase in the risk of developing oral mucositis. Other independent variables in the model were observed not to be associated with the risk of oral mucositis development in this sample group ($P > .05$; Table 3).

DISCUSSION

Oral health is considered an important indicator of the systemic and mental health status of patients, including

respiratory diseases such as COPD especially.^{1,7,23} Oral mucositis is one of the important health problems that patients with COPD suffer from due to various factors related to the disease itself and the treatment process.^{14,15} It was aimed in this study to determine the prevalence of oral mucositis and associated risk factors from the beginning of the treatment period in 7-day monitoring of COPD patients.

Our findings revealed the presence of oral mucositis in 61.9% of the patients included in the study. It has been reported in the literature that COPD patients tend to have more oral problems that contribute to poor oral health and the development of systemic diseases.^{7,15} On the other hand, some studies have also shown that poor oral health is significantly associated with an increased risk of COPD.^{1,24} These findings show that oral care has critical importance for both the prognosis of the disease and the prevention and management of complications that may develop due to oral mucositis in COPD patients.

In our study, the severity of oral mucositis developed in patients with a diagnosis of COPD and total oral mucosa scores, an indication of the increase in the severity of the changes in the oral mucosa of the patients, were determined to increase significantly during the 7-day monitoring period. In their study, Korkut et al¹⁵ reported that the severity of oral mucositis and mucositis-related symptoms were significantly higher during the 15-day monitoring period in patients with COPD in the control group compared to the group that received oral care intervention with black mulberry syrup. In another similar study, the severity of oral mucositis and complaints related to oral mucositis were found to be significantly higher in COPD patients in the control group compared to the patients in the intervention group in which oral care was carried out with aloe vera solution.¹⁴ While these findings reveal the fact that oral mucositis is a common problem in COPD patients, they highlight the importance of oral observation assessment and the necessity of effective oral care in this patient population.

As per our findings, the increase in the duration of COPD diagnosis of the patients was determined to be associated with the risk of oral mucositis development. The literature points out that various factors associated with the disease and the treatment process contribute to the risk of deterioration of oral health in patients with COPD. This finding also suggested that the increased risk of oral mucositis development in patients with a longer duration of COPD diagnosis may be related to their increased exposure to these factors, which are associated with the risk of disruption of oral mucous membrane integrity. It is known that COPD patients are a group of patients who have to deal with more than 1 accompanying disease, and as a result of which, their ability to fulfill their self-care needs, in particular, is negatively affected.²⁵ Therefore, this causes COPD patients to face the risk of deterioration of the oral mucous membrane. The patients included in this study were also observed to have various systemic diseases that may negatively affect their self-care abilities. In the literature, another aspect whose importance has been emphasized in relation to the deterioration of oral

health in COPD patients has been shown to be the presence of prostheses used by patients due to tooth loss in their mouth. Przybyłowska et al²⁶ reported a high susceptibility to oral mucosal infections in COPD patients and noted that one of the most important factors increasing this susceptibility is the effect of the prosthetic plaque biofilm layer, which has an increased risk of development due to the traumatic effect of prostheses in the mouth. This also draws attention to the importance of improving individual oral hygiene habits, especially in patients with COPD. However, studies show that the oral health status of COPD patients is generally poor and individual oral hygiene habits are insufficient.^{1,7,27} Similarly, in our study findings, the fact that tooth brushing habits of the patients, which may increase the susceptibility to deterioration of the integrity of the oral mucosa, are not at the desired level and the presence of prostheses in the mouth as a result of tooth loss is noteworthy.

Oxygen therapy has an important role in the treatment of hypoxemia-related symptoms and the relief of patients with COPD.²⁸ However, the serious complications that may be caused by high-intensity and continuous oxygen therapy, as well as the dryness and irritation that can be caused in the oral mucosa, highlight the necessity of assessing the condition of the mucous membranes and the importance of oral care in patients under oxygen therapy.²⁹ Our study findings, similar to the literature, revealed that the increase in the intensity of oxygen therapy, related to the presence of mucosal dryness that it may cause, is a risk factor that increases the risk of oral mucositis development. Khijmatgar et al¹³ reported that dry mouth, which can be caused by oxygen therapy, is a more common symptom in COPD patients and that dry mouth creates an opportunity for the colonization of candidal microorganisms. Ağaçdiken and Kara¹⁴ pointed out that dry mouth, which is one of the important factors supporting the formation of oral mucositis, is among the most common symptoms experienced by COPD patients. It has been shown in another study that the frequency of prosthetic stomatitis complicated by mucosal infections is higher in COPD patients and this might be related to oxygen therapy, which increases the susceptibility to dry mouth and thinning of the oral mucosa.²⁶

It is emphasized that the effect of pharmacological agents used in the treatment is another point that increases the susceptibility to deterioration of oral mucous membrane integrity in COPD patients.^{14,23} During the treatment protocols of the patients, together with the presence of accompanying systemic diseases, various medications that are known to cause dryness in and around the mouth, such as inhaled β 2-adrenergic receptor agonists or cholinergic receptor antagonist bronchodilators, and inhaled corticosteroids, which may jeopardize the durability of the integrity of the oral mucosa, are used. Dry mouth is reported to be one of the most important side effects of inhaled anticholinergics.²⁸ In studies, dry mouth was observed to be among the most commonly reported complaints by COPD patients.^{1,14,15,23} Furthermore, some antibiotics used in the treatment protocol are known likely to lead to candidal infections in the oral mucosa.¹³ Khijmatgar et al¹³ reported that the candidal load on the oral mucosa was higher in COPD patients when compared to the

control group, and theophylline, which is often used for its bronchodilator effect, might be a risk factor for increased candidal load in COPD patients. Antibiotics and bronchodilators, known to increase the susceptibility to oral candidal infections, were observed to be among the pharmacological agents frequently used in the sample group of this study.

Our study findings showed that the most important risk factor leading to the development of oral mucositis in COPD patients in the sample group was the use of medication containing corticosteroids in the treatment protocol. Inhaled corticosteroids are often used in combination with bronchodilator medications in patients with severe complaints and accompanied by hypoxemia. Besides, oral candidiasis is known to be among the most common side effects experienced by patients due to inhaled corticosteroids.²⁸ Miravittles et al³⁰ reported the presence of a strong relationship between the use of inhaled corticosteroids in the treatment of COPD and the development of oral candidiasis. It was pointed out in another study that the use of inhaled corticosteroids without a tool called Spacer may be an important factor in the increase of oral candidal load in COPD patients.¹³ Moreover, the literature recommends teaching the correct inhalation technique to them to reduce the risk of oral candidiasis in patients treated with inhaled corticosteroids, using the inhaler with the help of a tool called Spacer, rinsing the mouth after the use of the medication and providing oral hygiene.^{13,31} These results also highlight the necessity of nursing care to maintain oral health and prevent complications in patient care, while emphasizing the importance of awareness of oral health-related problems that may be caused by treatment-related factors in COPD patients.

It is known that exposure to direct and passive smoking has a significant effect on the gingival and oropharyngeal flora.^{1,13} In addition, it is a well-known fact that cigarette smoke makes the oral mucosal epithelium more susceptible to the colonization of pathogens.³² Saltnes et al²³ reported that smokers with COPD had more oral health problems and that smoking habits impaired oral health-related quality of life. In this study, according to the regression analysis findings, it was seen that having a smoking habit did not have a significant effect on the risk of developing oral mucositis. Similar to our findings, Ağaçdiken and Kara¹⁴ reported that there was no significant effect of smoking among the factors affecting oral mucositis in the experimental and control groups. In a study conducted with a different patient population, it was reported that smoking did not significantly affect the risk of developing oral mucositis.³³ Unlike our findings, in the study conducted by Korkut et al.¹⁵ it was reported that there was a significant relationship between the duration of smoking habit and the severity of oral mucositis in patients with COPD. Different results in the literature show that the effect of smoking on the development of oral mucositis needs further investigation.

This study has some limitations. The most important limitation is that the study was conducted in a single center and with a limited sample. Furthermore, the findings regarding the oral mucosa of the patients were obtained based on the results of a 7-day monitoring period. In addition, the findings regarding the presence of oral mucositis in patients are limited to the

macroscopic evaluation. This may have led to the inability to objectively assess the prevalence and severity of oral mucositis and to overlook the changes that may develop in the oral mucosa after 7 days of the monitoring period. Therefore, these limitations restrict the generalization of the study results to all COPD patients. Therefore, future studies should focus on the design in which macroscopic changes in the oral cavity are supported by microscopic examinations in COPD patients. However, in addition to the current limitations, the findings from this study revealed some important results regarding the oral mucositis issue and its associated risk factors, which should be considered an important priority in COPD patients, and contributed to the limited literature in this field. This can be considered the strength of our study.

CONCLUSION

The results obtained from this study support that oral mucositis is a commonly experienced problem in COPD patients due to the risk factors associated with the chronic disease process and its treatment and that maintaining oral health is critical in this patient population. Furthermore, while the severity of oral mucositis and changes in favor of deterioration in the integrity of the oral mucous membrane in COPD patients tended to increase significantly from the third day onward of the treatment period, patients who were with a longer duration of COPD diagnosis, have been treated with medications containing corticosteroids and need high-intensity oxygen therapy, were determined to be at higher risk for oral mucositis development.

In line with these results, in the treatment and care process of COPD patients, it is recommended to consider the prevention and follow-up of oral health-related problems as a priority, improve the behaviors of patients to have better oral health, and maintain the integrity of the oral mucous membrane with a planned oral diagnosis and oral care in line with the evidence-based recommendations which are among preventive nursing care practices, especially for patients with reduced self-care and risk factors.

Ethics Committee Approval: This study was approved by the Ethics Committee of Afyonkarahisar Health Science University, Non-Interventional Clinical Research Ethics Committee (Decision No: 2020-470).

Informed Consent: Written informed consent was obtained from the patients who participated in this study.

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