

Evaluation of the relationship between the acute attacks in chronic obstructive pulmonary disease and oral health by Rustogi index

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ABSTRACT

Aim: To examine the relationship between the acute attacks of the patients with chronic obstructive pulmonary disease (COPD) and their general oral hygiene and the general condition of their prostheses.

Methods: As a prospective questionnaire and clinical examination study, patients with COPD attacks using total prostheses and healthy individuals were compared using the Rustogi index. After obtaining consent from all patients, age, Modified Medical Research Council Dyspnea Scale (Mmrc) scores, an inhaler used, COPD stage, and the status of total prostheses were recorded. Also the habits of the use of the prostheses were evaluated for each group.

Results: 32 COPD patients and 34 healthy participants, 29 female and 37 male, with a mean age of 69.19±3.16 were evaluated. When the correlation between COPD attack and denture cleaning frequency, which was the main hypothesis of the study, was evaluated, a significant correlation was observed. ($r:0.549$, $p<0.001$) There was a significant difference between the patient and healthy individuals whether they removed the dentures at night and the frequency of denture cleaning. ($p<0.01$)

Conclusions: In COPD, whether both mechanical and pharmacological cleaning of the prostheses is done regularly should be evaluated at each control. Regular dental check-ups can control the course of the disease, as well as contribute to reducing morbidity, mortality, and also health outgoings. Further studies in which serum inflammatory markers and microbiological examinations will be evaluated can be recommended.

Key words: Obstructive pulmonary disease, acute attacks, oral health, Rustogi index.

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Introduction

Chronic obstructive pulmonary disease (COPD) is a common, preventable, and curable illness defined by a chronic restriction in airflow and respiratory symptoms by regular exposure to

some particles or gases [1]. It is predicted that smoking will become the third most prevalent cause of mortality due to the rising smoking rates in emerging nations and the aging of the population in wealthy nations [2]. In several studies that the attacks of COPD—which are mostly brought on by the aspiration of pathogenic microorganisms, particularly through the nasopharynx—are the major cause of morbidity and mortality [3–8]. We know that the oral flora contains a variety of bacteria, including Streptococcus pneumoniae, Hemophilus

influenza, *Moraxella catarrhalis*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Proteus mirabilis*, and *Candida suppurativa* [9-11]. These microorganisms form a structure called biofilm, not as single cells, so they can be organized and protected from external factors.

When a comparison is made according to the presence of natural teeth in the presence of prosthesis in the mouth, there are differences in the oral environment. Full dentures' tissue-enclosed sections obstruct saliva flow, restricting mucosal epithelial cells' access to oxygen, reducing pH, and altering the temperature and number of food particles still present. Consequently, saliva's antibacterial capabilities are diminished [12]. Because they are unable to access the doctor's controls, patients, especially the elderly, may have to use their prostheses for an extended period of time. As a result, poor prosthesis stability and the biofilm layer that readily accumulates when the prosthesis surface deteriorates and the patient is unable to maintain proper oral hygiene may be the origin of infections [13,14].

Considering that COPD is a more common disease in older ages, the plaques accumulated on dentures that are not cleaned adequately are examples of bacterial and fungal biofilms that can serve as reservoirs for potentially pathogenic respiratory microorganisms. In this study, we aimed to investigate the relationship between the acute attacks of COPD patients and the oral hygiene, and the general condition of the prostheses.

Materials and methods

This is a prospective questionnaire and clinical examination study. Patients who were hospitalized in the pulmonology service with the diagnosis of acute attack or were treated as an outpatient in the outpatient clinic and using full

prosthesis were included in the research. Age, Modified Medical Research Council Dyspnea Scale (mMRC) scores, and an inhaler used were recorded after obtaining the consent of all patients who were divided into a healthy control group and a COPD attack patient group. The criteria used for the diagnosis of COPD were set according to the GOLD guidelines. According to the combined COPD staging, patients with a known diagnosis of COPD were evaluated for exacerbation in their emergency and/or outpatient clinic admissions. Patients who are active smokers, have previous pulmonary tuberculosis, asthma, lung cancer, interstitial lung disease, etc. another lung disease, are pregnant, diagnosed with Alzheimer's disease, have any organ malignancy, have a history of previous lung surgery, and do not using full dentures were not included. After the treatment was applied to the people who came with attack symptoms, questions about oral health were asked and information about oral health was given. BAIBU ethics committee approval was obtained for the study. (Ethics committee no: 2019 / 195 – 2021 / 264)

COPD Attack Assessment

The GOLD report defines an attack as an acute occurrence that is marked by a worsening of the patient's respiratory symptoms (cough, shortness of breath, increase in sputum quantity, and/or purulence) and above the daily observed normal change and results in a change in treatment. Exacerbation severity is categorized based on the types of treatments and classified as mild, moderate, and severe. Accordingly, a mild attack requires simply the use of short-acting bronchodilators (SABA), a moderate attack requires the addition of oral corticosteroids or antibiotics to SABA, and a severe attack necessitates admission to the hospital or emergency department care [1]. In patients who

experienced an attack, no laboratory test or other procedure was done for costs.

Assessment of Prosthetic Hygiene

Following a diagnosis of a COPD attack, the patient underwent a thorough intraoral examination and answered questions regarding oral hygiene and general health. The colorations were then recorded by grading the stained regions in accordance with the Rustogi Modified Navy (RMN) index after the same practitioner applied the oral plaque staining agent to the prosthesis (Figures 1 and 2). This represents the broad surface area of the whole buccal or lingual surfaces while giving focus to the gingival third of the tooth and grades plaque and debris on a scale (Figure 3). The patient was made aware of the current oral hygiene practices and prosthetics.

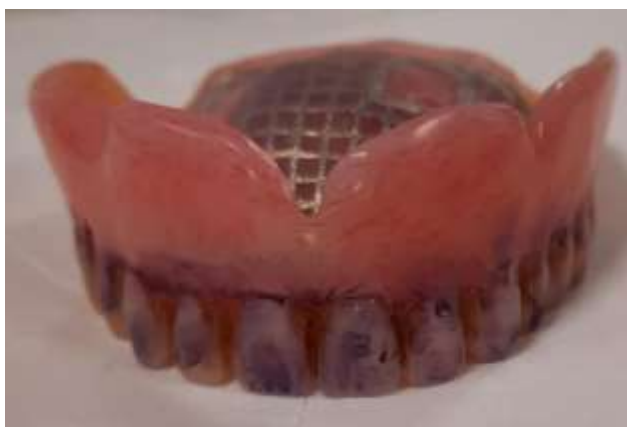


Figure 1. Maxillary prosthesis colored with plaque stainer.



Figure 2. Mandibular prosthesis colored with plaque stainer.

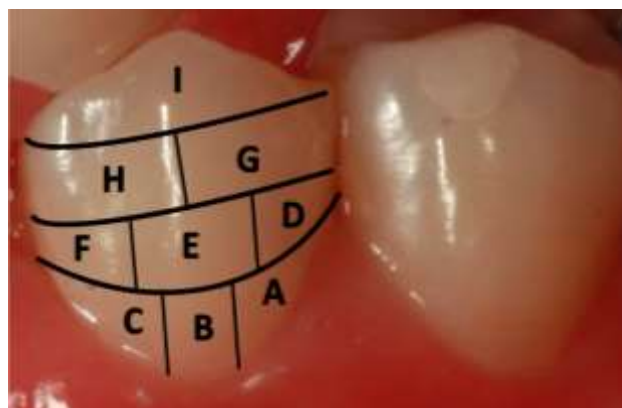


Figure 3. Representation of the regions scored according to the Rustogi Modified Navy (RMN) index on the tooth.

Statistical analysis

In this cross-sectional study, a t-test was used for independent groups, the Mann-Whitney U test was used for pairwise group comparisons, and Chi-Square tests were used to evaluate categorical data. When numerical data are evaluated with the Shapiro-Wilk test, it is seen that the data are not normally distributed ($p < 0.001$). Mann-Whitney U test was used in pairwise group comparisons and Chi-Square tests were used in the evaluation of categorical data. The spearman correlation coefficient was used to evaluate the correlation between COPD parameters and RMN index values, and the correlations between COPD attacks and denture cleaning frequency.

Results

In this study, 32 patients with COPD and 34 healthy participants using full dentures were evaluated. The mean age of 29 female and 37 male participants was 69.19 ± 3.16 . When the correlation between COPD attack and denture cleaning frequency, which was the main hypothesis of the study, a significant correlation was evaluated. ($r: 0.549$, $p < 0.001$). In addition, when the correlation between the mMRC value

Table 1. Evaluation of RMN indices in healthy and COPD patients.

Rustogi index	Groups				p value
	COPD		Healthy		
	Mean±SD	Median (Min.-Max.)	Mean±SD	Median (Min.-Max.)	
A+D (Mesioproksimal)	25.18±12.85	21.50 (6-45) ^a	18.85±10.78	19.00 (2-45) ^b	.030
A+B+C (Gingival)	46.78±15.36	48.00 (12-69) ^a	37.41±15.09	38.00 (11-66) ^b	.018
C+F (Distoproksimal)	31.62±10.77	36.50 (8-44) ^a	23.52±10.40	24.50 (7-43) ^b	.003
H+G (Mild 1/3)	14.31±6.69	12.00 (3-24) ^a	9.73±4.75	10.00 (2-23) ^b	.012

RMN: Rustogi Modified Navy COPD. Chronic obstructive pulmonary disease.

Table 2. Evaluation of prosthesis use in Healthy and COPD patients.

Groups	Prosthesis usage period					p value
	0-6 month n (%)	7-12 month n (%)	13 month-5 years n (%)	6-10 years n (%)	+10 years n (%)	
COPD	0 (0)	2 (6.3)	2 (6.3)	7 (21.9)	21(65.6)	.198
Healthy	1 (2.9)	5 (14.7)	7 (20.6)	5 (14.7)	16 (47.1)	
	Can you remove your dentures at night?					
	Yesn (%)		No n (%)			<0.01
COPD	11 (34.4)		21 (65.6)			
Healthy	28 (82.4)		6 (17.6)			
	Denture cleaning frequency					
	1 per week n (%)	Every 2 days n (%)	1 time per day n (%)	2 times per day n (%)	After every meal n (%)	<0.01
COPD	8 (25)	18 (56.3)	3(9.4)	1(3.1)	2(6.3)	
Healthy	3 (8.8)	6 (17.6)	2(5.9)	0(0)	23(67.6)	

Table 3. Evaluation of dentist visiting habits in Healthy and COPD patients.

GROUP	How often have you visited your dentist in the last 5 years?			p value
	1 time per year n (%)	2 times per year n (%)	None n (%)	
COPD	0(0)	4(12.5)	28(87.5)	<0.01
Healthy	14(41.2)	12(35.3)	8(23.5)	
	What is your reason for going to the dentist?			
	Regular check n (%)		Pain and complaint n (%)	.036
COPD	3(9.4)		29 (90.6)	
Healthy	10 (29.4)		24(70.6)	

Table 4. Evaluation of the use of oral hygiene products in Healthy and COPD patients.

Groups	Use of oral hygiene products		p value
	Manual toothbrush		
	Yes n (%)	No n (%)	<0.01
COPD	23 (71.9)	9 (28.1)	
Healthy	9 (26.5)	25 (73.5)	
	Mouthwash		.156
	Yes n (%)	No n (%)	
COPD	2 (6.3)	30 (93.7)	
Healthy	6 (17.6)	28 (82.4)	
	Toothpaste		.281
	Yes n (%)	No n (%)	
COPD	10 (31.3)	22 (68.8)	
Healthy	15 (44.1)	19 (55.9)	
	Denture cleaning brush		0.01
	Yes n (%)	No n (%)	
COPD	9 (28.1)	23 (71.9)	
Healthy	23 (67.6)	11 (32.4)	
	Tongue Cleaning Brush		.204
	Yes n (%)	No n(%)	
COPD	3 (9.4)	29 (90.6)	
Healthy	7 (20.6)	27 (79.4)	
	Soap		.135
	Yes n (%)	No n (%)	
COPD	12 (37.5)	20 (62.5)	
Healthy	19 (55.9)	15 (44.1)	

and the RMN index values is considered, in the negative direction [r: 0.415, $p=0.001$ for A+D, r:0.338 for A+B+C, $p=0.006$, r:0.302 for C+F, $p=0.014$, r:0.360 for H+G, $p=0.003$]; Considering the correlation between inhaler use and RMN index values, a negative correlation was observed again [For A+D r: 0.390, $p=0.001$, for A+B+C r: 0.261, $p=0.034$, for C+F r: 0.245, $p=0.048$, for H+G r: 0.321, $p=0.009$]. A negative correlation was observed in the correlation between COPD attack value and RMN index values [for A+D r: 0.370, $p=0.002$, for A+B+C r: 0.278, $p=0.024$, for C+F r: 0.252, $p=0.041$, for H+G r: 0.302, $p=0.014$] (Table 1). When the difference between the prosthesis usage times of the patients and

healthy individuals was examined, no significant difference was observed ($p: 0.198$) (Table 2).

There was a significant difference between the patient and healthy individuals whether they removed the dentures at night and the frequency of denture cleaning ($p < 0.01$). Similarly, a significant difference was observed in terms of frequency and reasons for going to the dentist (Table 3).

When the difference between the oral hygiene products used by these 2 groups was evaluated, there was no difference in the use of mouthwash, soap, tongue cleaning brush and toothpaste, while there was a difference in the use of manual and prosthetic toothbrushes ($p > 0.05$) (Table 4).

Discussion

The oral biofilms which are readily formed on the surfaces of teeth and prosthetic devices are not removed by practicing oral hygiene, the collected bacteria may negatively impact both oral and respiratory health. Considering that the most important cause of morbidity and mortality in COPD is exacerbations, and these attacks are caused by various microorganisms, it can be said that oral prostheses can almost act as a growth medium in the oral flora. In addition, corticosteroid-containing inhaler treatments used in the treatment of COPD may improve for both bacterial and fungal infections. In this study, patients diagnosed with COPD attack by the Pulmonology Department of a tertiary hospital, inpatient or outpatient treatment and healthy individuals were compared in terms of prosthesis use. It was investigated whether the frequency of exacerbations increased in patients with COPD who did not clean their dentures regularly and had poor oral hygiene.

Various studies have shown that each attack in COPD affects mortality according to its severity [2-8]. Cleaning the prosthetics that impact oral health is particularly important because microorganisms are the most common cause of attacks. It is known that COPD is common in the elderly population, and patients in this age group mostly use full dentures. Liu et al. (15) predicted that the frequency of attacks may increase in COPD patients with poorer oral hygiene. In another study conducted in the ICU, it was shown that the use of 0.2% gel chlorhexidine twice a day to clear plaques in the mouth can reduce the risk of pneumonia in hospitalized patients [9]. *Escherichia coli*, *Pseudomonas* spp., *Klebsiella* spp., and *Staphylococcus* species were identified from plaques in another study comparing healthy and

COPD patients, and it was underlined that this scenario may play the role for respiratory tract infections [16]. In a research, it was shown that bacteria that reside in the biofilm layer on plaques are more treatment-resistant [17]. When the link between COPD attacks and the frequency of denture cleaning was analyzed in this study, a significant correlation was found. ($r:0.549$, $p<0.001$)

Lung functions may decline in many dental and gingival diseases, particularly in childhood caries, tooth loss, periodontitis, and aphthous stomatitis. This may be a result of chronic inflammation in the mouth, and it may cause in small changes to the airways, particularly respiratory function. It has been demonstrated that it might influence test outcomes and even be connected to the presence of emphysema on a CT scan [18-20]. Patients who had an average dental bone loss of more than 4 mm were at risk for COPD, according to research, although no correlation was established between these patients' alterations in radiological or respiratory parameters [21]. As far as we know, this is the first study in which full dentures and plaques formed on them were shown using the RMN index, and their relation with COPD attack was investigated. Considering that smoking and age factors pose a common risk, this relationship can be expected. However, active smokers were excluded from the study, considering that smoking status may affect the results.

There are several investigations comparing dental plaque and induced sputum microbiological analyses in stable COPD. In a recent research, it was shown that the mouth cavity might serve as a reservoir for upper and lower respiratory tract infections and that 91.9% of the agents found in plaques and sputum (*S. aureus*, *Serratia* spp., *Klebsiella pneumoniae*, and *Pseudomonas* spp.) were compatible [22]. The use of inhaled corticosteroids, whose dosages are

raised during attacks and are used as a therapy, is recognized to have potential benefits, particularly for the treatment of oral fungal infections. According to studies, end-stage COPD patients receive oxygen assistance at home, which might dry up the oral mucosa and alter the components of saliva output [23,24]. Additionally, a nursing home research found that using a toothbrush and other oral hygiene items on a daily basis helps elderly patients with aspiration pneumonia said to be avoidable [25-27]. In this study, it was shown that the frequency of denture cleaning varied significantly between patients and healthy people. Similarly, a significant difference was observed in terms of the frequency and reasons for going to the dentist. When the difference between the oral hygiene products used by these two groups was evaluated, there was no difference in the use of mouthwash, soap, tongue cleaning brush and toothpaste, while there was a difference in the use of manual and prosthetic toothbrushes. As a result, it can be said that healthy subjects are more educated and attentive to oral health.

The limitations are the observational status of the study, the limited number of cases, the exclusion of active smokers, the lack of information on the individuals' smoking history over time, and the inability to grade the acrylic prosthetic components. Additionally, it might be advised that future research take into account the fact that no evaluation of serum inflammatory markers or microbiological tests has been done.

Conclusions

Oral hygiene is of great importance in COPD compared to other patient groups. Both the drug treatments used and the inhalation and nasal treatments affect the immune system and prepare the ground for microbial colonization. It can be suggested that the use of soap, tooth and tongue brushes and mouthwash in these patients, as well

as the regularity of both mechanical and pharmacological cleaning of prostheses, should be evaluated at each control of COPD patients. Giving importance to oral hygiene and ensuring that these patients go to regular dental check-ups can contribute to reducing morbidity and mortality as well as health expenditures by controlling the course of the disease and preventing attacks.

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