
The Prevalence of Oral Inflammation Among Denture Wearing Patients with Chronic Obstructive Pulmonary Disease

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Abstract

Oral inflammation is an important contributor to the etiology of chronic obstructive pulmonary disease, which can impact patient's health status. Previous studies indicate that people with poor oral health are at higher risk for nosocomial pneumonia. Denture wearing is one promoting factor in the development of mucosal infections. Colonization of the denture plaque by Gram-negative bacteria, *Candida spp.*, or other respiratory pathogens, occurring locally, may be aspirated to the lungs. The studies showed that chronic obstructive pulmonary disease (COPD) patients treated with combinations of medicines with corticosteroids more frequently suffer from *Candida*-associated denture stomatitis. Treatment of oral candidiasis in patients with COPD constitutes a therapeutic problem. Therefore, it is essential to pay attention to the condition of oral mucosal membrane and denture hygiene habits. The guidelines for care and maintenance of dentures for COPD patients are presented in this paper. The majority of patients required improvement of their prosthetic and oral hygiene. Standard oral hygiene procedures in relation to dentures, conducted for prophylaxis of stomatitis complicated by mucosal infection among immunocompromised patients, are essential to maintain healthy oral tissues. The elimination of traumatic denture action in dental office, compliance with oral and denture hygiene, proper use and storage of prosthetic appliances in a dry environment outside the oral cavity can reduce susceptibility to infection. Proper attention to hygiene, including

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brushing and rinsing the mouth, may also help prevent denture stomatitis in these patients.

Keywords

Denture plaque • Denture stomatitis • COPD • Oral hygiene • Oral inflammation

1 Introduction

Chronic obstructive pulmonary disease (COPD) is characterized by irreversible, limited flow of air through the respiratory tract, related to a chronic inflammatory process in lung vessels, destruction of lung parenchyma, and progressive morphological changes in pulmonary alveoli (Murray and Lopez 1997). COPD mainly develops in active and passive smokers or persons exposed to air pollution. The course of the disease depends on patients' general health, age, and the existence of comorbidities. COPD is currently one of the leading health issues in the world and is projected to be the third most common cause of death by 2020, one which substantially diminishes the quality of life (Zhou et al. 2011). Patients with frequent exacerbations require hospitalization and increasing financial expenditure for medical services. Infections constitute the main cause of exacerbations in the course of COPD, whereas a significant part of nosocomial pneumonias is initiated through the aspiration to the lower respiratory tract of opportunistic bacteria colonizing oral cavity and nasopharynx. Microorganisms mainly causing pneumonia in the course of COPD belong to the commensal bacterial flora colonizing the epithelium of the nasopharynx: *Haemophilus influenzae*, *Moraxella catarrhalis*, and *Streptococcus pneumoniae*. In patients with severe COPD exacerbations, following types of bacteria are isolated from saliva: *Pseudomonas aeruginosa*, *Escherichia coli*, and *Proteus mirabilis* (Sethi 2010). Chronic local and systemic inflammation related to the colonization of bacteria in the respiratory tract impairs the mucociliary clearance, leading to the destruction of pulmonary alveoli and obturation of the

respiratory tract. The etiology of COPD exacerbations depends on the severity of the disease, their frequency of appearance, and the applied antibiotics. Patients with COPD belong to the group of persons with acquired immunodeficiency, who are at risk of *Candida* infections and bacteremia. Chronic local oral cavity inflammation and systemic inflammation impair the mechanisms of humoral and cell-mediated immunity, which promotes the colonization of upper and lower respiratory tract pathogens. Hospitalized patients with advanced COPD are at the highest risk of developing pneumonia and bronchitis (Murphy 2006; Didilescu et al. 2005; Scannapieco et al. 2003).

Over the past decade there has been an increased interest in the link between respiratory tract diseases and infections within oral cavity and nasopharynx (Paju and Scannapieco 2007; Scannapieco 2006; Mojon 2002). Microorganisms exist in the oral cavity not in the form of single cells, but as organized structures forming an ecological niche called biofilm. The ability to form biofilm decides about the pathogenicity of the microorganism, and in this way directly influences the soft tissues of the upper respiratory tract. Their products have been shown to stimulate mucin secretion and may result in the release of antigens, including endotoxins, lipoproteins, peptidoglycans, and other molecules enhancing the effectiveness of anti-inflammatory activities in the respiratory tract and the whole body. Previous research indicates that insufficient oral cavity hygiene contributes to the development of pneumonia. A significant part of nosocomial pneumonias is initiated through the aspiration into lower respiratory tract of bacteria colonizing oral cavity (Scannapieco 2006).

Removable prosthetic restorations create convenient conditions for the growth of bacterial and fungal microflora in the oral cavity. Broad denture plaque impedes the saliva flow and its anti-septic action, limits the ingress of oxygen to the mucous membrane epithelial cells, causes a pH decrease and an increase in temperature, as well as contributes to the build-up of food debris. Elderly patients use dentures for many years, without appearing for control visits to reline them or replace with new ones. Poor stability and retention of prosthesis related to this fact becomes a traumatogenic factor for the oral cavity mucous membrane. Among COPD patients, predominate elderly persons using removable prosthetic restorations made of acrylic materials. These materials are characterized by porosity and surface roughness, which promote the adherence of microorganisms, food debris, and the formation of biofilm of the denture plaque. Strong acrylic surface adherence is shown by *Candida albicans*, owing to the presence of phospholipases and other hydrolytic enzymes. Poor hygiene of oral cavity and prosthetic restorations promotes the build-up of bacterial-fungal plaque, which interacts directly with the mucous membrane of the prosthetic area (Sumi et al. 2002). In certain patients, denture plaque contributes to the development of prosthetic stomatitis, a chronic local inflammation of the oral cavity mucous membrane. Denture stomatitis mostly concerns removable dentures, and affects from 15 % up to 70 % of denture users. Among the risk factors for the occurrence of stomatitis are: *Candida spp* fungal infections, mechanical damage, poor oral hygiene, and round-the-clock use of dentures (Ramage et al. 2004).

COPD patients are encumbered with a high risk of bacterial and fungal infections, particularly *Candida spp*. Our previous studies indicate that multiple pathogenic species related to pneumonia have been isolated from the removable denture plaque of COPD patients. Sixteen bacterial strains responsible for exacerbations of the disease have been identified, including: *S. aureus*, *P. aeruginosa*, *E. coli*, *K. pneumoniae*, and *Serratia spp*. COPD patients show poorer denture hygiene and prosthetic

stomatitis complicated by fungal infection, being more frequent that could be explained by the use of chronic inhalation glucocorticosteroids and home oxygen therapy in this group of patients (Przybyłowska et al. 2015).

The elimination of denture plaque, dental plaque and the reduction of bacteria and fungi adherence to the porous surface of acrylic material ought to constitute the basic measure in reducing general inflammations in the oral cavity (Abe et al. 2006; Gornitsky et al. 2002).

2 Guidelines for Oral and Denture Hygiene for COPD Patients

Proper daily hygiene of removable dentures is necessary for the prophylaxis and reduction of bacterial plaque adherence, food debris build-up, and the formation of tartar. Moreover, it is relevant for the maintenance of the health of gums and teeth, as well as for the elimination of mouth odor. It is advisable to clean dentures mechanically, chemically, or by combining these two methods of removing denture plaque. Removable dentures are recommended to be cleaned after each meal using mechanical methods, with a special denture brush, with the use of soap and warm running water, for 5 min (Rathee et al. 2009). For persons with hindered manual ability, it is recommended to perform hygiene procedures over a sink lined with a towel, or filled with water, to minimize the risk of denture damage. When cleaning the prosthetic restorations, patients should also clean the remaining teeth and the tongue. Toothpastes or pastes with added abrasives should be avoided while cleaning dentures, as these may scratch the acrylic material, of which the denture is made. Ultrasound denture cleaners with various types of antiseptic liquids or detergents ought to be used in nursing homes and hospitals. Alternatively, cleaning enzymes in the tablet form, which dissolve and chemically remove the plaque biofilm, can be applied (Adachi et al. 2007). It is unacceptable to place dentures in solutions containing sodium hypochlorite for

more than 10 min, as this could damage the acrylic material. After careful cleaning, dentures ought to be stored in a dry environment to limit the ingrowth of bacteria and fungi in the porous structure (Jackson et al. 2014). For stomatitis prophylaxis, it is advisable to observe a several hours' night break in using dentures.

COPD users of removable dentures often report a burning sensation and the feeling of oral cavity dryness when inhale drugs containing glucocorticosteroids (Sjorgren et al. 2008). Moreover, broad denture plaque hinders the oxygen ingress to the mucous membrane, disturbs the balance between certain types of microorganisms, and causes more frequent inflammatory changes (prosthetic stomatitis) than in other groups of patients. In the etiology of stomatitis, a particular role belongs to *Candida spp* fungal infection. Therapeutic proceedings in denture stomatitis complicated by a fungal infection are based mainly on a combination of prosthetic and pharmacological therapy. In case of suspected fungal infection, swabs from denture plate, alternatively from the mucous membrane of the palate, cheeks or tongue are collected, which are then cultivated on Sabouraud agar under aerobic conditions. The replica method is an alternative where fungal infections cannot be confirmed due to negative mucous membrane swab test, and patients subjectively report discomfort in the oral cavity. An agar model cast from denture plate is incubated under aerobic conditions, and the cultivated *Candida albicans* colonies are located exactly in the place of abutting mucous membrane. Immuno-compromised and elderly persons ought to carefully follow the guidelines for oral cavity hygiene. It is recommended to brush teeth after each meal, alternatively each morning and evening, for 3 consecutive minutes using a soft brush and fluoride toothpaste, as well as to use dental floss to clean the areas between teeth (Ramage et al. 2004). Patients with limited manual ability are recommended to use electronic or sonic toothbrushes. Patients on nebulized inhalation drugs ought to brush teeth and irrigate the mouth immediately after taking them (Godara et al. 2011). Patients at advanced disease stage

and elderly persons with gums or mucous membrane inflammation are recommended to use 0.12 % chlorhexidine mouth rinse (DeRiso et al. 1996). Scannapieco et al. (2003) proposed the use of 0.20 % chlorhexidine gel twice a day in hospitalized patients, which may decrease the incidence pneumonia in intensive care patients.

In case of prosthetic restorations or retention systems supported by remaining teeth or implants, such overdentures with ball attachment, bars, and telescopic crowns, it is also recommended their surface be cleaned with dental toothpastes, special dental flosses, single-tuft toothbrushes, and oral irrigators. Elements fixed in removable overdentures ought to be cleansed with toothbrush and soap. Mouth rinses without alcohol are advisable.

3 Discussion

Negligence of hygiene of oral cavity and prosthetic restorations is a relevant factor predisposing to the occurrence of mucous membrane infections at the base of denture attachment. The elimination of denture and dental plaque, as well as the reduction of bacteria and fungi adhesion to the porous surface of acrylic material ought to constitute the basic manner of reducing general inflammations. Research indicates that the presence of respiratory tract pathogens in dental plaque and in dentures modulates the immunoresponse of the host, influencing the course of the basic disease (Sethi 2010; Przybyłowska et al. 2014). Adachi et al. (2007) have shown that a combination of professional mechanical and chemical oral cavity cleaning substantially reduces the number of pathogens in dental plaque of elderly persons. The adherence to oral hygiene guidelines is of notable importance, particularly in patients on inhaled steroids or other immunomodulating drugs, in order to prevent the passage of bacteria and fungi into the lower respiratory tract.

The research conducted by Liu et al. (2012) indicates that poor oral hygiene and ample dental plaque build-up increase the frequency of COPD exacerbations. Rosenblum (2010) has shown in

his metaanalysis that mechanical cleaning procedures in oral cavity may prevent death due to aspiration pneumonia, in one out of ten elderly nursing home residents. Regular seeing dentists by COPD patients wearing removable dentures allows for prophylaxis and early detection and treatment of oral cavity inflammatory states. Prophylactic dental check-ups and elimination of denture plaque during regular visits, and the adherence to every day hygiene clearly decrease the risk of COPD exacerbations and thus also enable a better control of this chronic disease.

Conflicts of Interest The authors declare no conflicts of interest in relation to this article.

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