Research Article

IMPACT OF ASTHMA ON ORAL HEALTH: A REVIEW

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ABSTRACT

Asthma is a chronic disease that affects the lower airways. It is characterized by recurrent and reversible airflow limitation due to an underlying inflammatory process. An approximately 300 million people worldwide have been diagnosed with asthma and there may be an additional 100 million diagnosis by 2025. Asthma medication comprises bronchodilators, corticosteroids and anticholinergic drugs. Most of these drugs are inhaled using various forms of inhalers or nebulizers. The effect of these drugs on oral health is the subject of debate among dental practitioners. However, no consensus has yet been established regarding whether these medications affect oral health. It is important to have knowledge about the impacts of asthma medications on oral and dental health and to take the necessary precautions in order to maintain it. In this review, in addition to investigation of the impact of asthma medications on oral health, possible measures that can be taken were also evaluated.

INTRODUCTION

Asthma is a chronic disease that affects the lower airways. It is characterized by recurrent and reversible airflow limitation due to an underlying inflammatory process. The etiology of asthma is unknown, but allergic sensitivity is seen in most patients with asthma. Genetic factors play a role, but no single gene or combination of genes has yet been identified as causative (Martin GS et al., 2015). The symptoms include shortness of breath, coughing, chest tightness, and rapid breathing. Severity of asthma can be classified as mild, moderate or severe (Sultan and Nasibe, 2016).

Asthma has become one of the most common chronic diseases in industrialized countries, and its prevalence is increasing throughout the world (Pramod et al., 2017). It is a growing public health problem affecting over 300 million people worldwide. It is estimated that an additional 100 million may be diagnosed with asthma by 2025 (Thomas et al., 2010). Asthma affects all age groups and is often persistent, accounting for a large proportion of health care spending and loss of work (Pramod et al., 2017). The rise in asthma prevalence noticed in the past decades has been too rapid to implicate genetic basis for the changes. However, various environmental factors or lifestyle factors have been implicated and in the last decade, hygiene hypotheses have been put forward as an explanation for the increased prevalence of asthma (R.KBehl et al., 2010).

Several studies have shown that in patients with moderate-to-severe asthma, there is an improvement in asthma control and significant reduction in severe exacerbations if a budesonide/formoterol combination inhaler is used as a reliever instead of a short-acting beta-2 agonist, whereas maintenance therapy with budesonide/formoterol is administered twice daily as usual. This strategy is now known as single inhaler maintenance and reliever therapy (SMART). Other medications used for asthma are Corticosteroids (prednisolone therapy), bronchodilators, omalizumab, TNF-α, antileukotrienes (Peter 2012).

The main concern when treating any medically complex patient is to avoid exacerbation of the underlying condition. Several protocols suggesting appropriate procedures for dental treatment of asthmatic patients have been put forth. However, numerous dental products and materials, including toothpaste, fissure sealants, tooth enamel dust, and methyl methacrylate, have been associated with the exacerbation of asthma whereas other items (such as fluoride trays and cotton rolls) have been suggested as being so associated. There is still no consensus regarding the association between asthma and dentofacial morphology. Although nasal respiratory obstruction resulting in mouth breathing has been implicated in the development of

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a long and tapered facial form, an increased lower facial height, and a narrow maxillary arch, this relationship has never been substantiated with unequivocal evidence. Oral manifestations include candidiasis, decreased salivary flow, increased calculus, increased gingivitis, increased periodontal disease, increased incidence of caries, and adverse effects of orthodontic therapy (Martin GS et al, 2015). This article reviews the correlation between asthma and oral health, and suggests various measures to counter possible oral health problems related to asthma.

Asthma and Dental Caries

Dental caries is a multifactorial disease progressing as a result of the mutual interactions between environmental, behavioural and genetic factors. Dental caries progress through a complex mechanism which includes demineralization of enamel by means of the organic acids produced by microorganisms in dental plaque. Chemical dissolution of the enamel occurs at pH 5.5. The normal pH of the oral environment is 7.0.

Some researchers reported increased caries prevalence in asthmatic children (Sultan and Nasibe, 2016). McDerra et al. pointed out that asthmatic children have more tooth decay affecting permanent teeth (Esther et al, 1998). A study by Reddy et al. suggested that asthmatic children have a high prevalence of caries and this increases with the severity of bronchial asthma (Thomas et al, 2010). Ersin et al. showed that asthma, through its disease status and its pharmacotherapy, includes some risk factors such as a decrease in the salivary flow rate and salivary pH for caries development. They also demonstrated that the duration of medication and illness has a significant influence on the risk of developing caries in asthmatics (Nazan et al, 2006) Shashikiran et al. showed that asthmatic people using salbutamol have more dental caries compared to controls. When the drug-related effect was analyzed, beclamethasone inhaler showed an increase in caries but not very significant when compared to salbutamol inhaler and salbutamol tablets. The salbutamol tablets showed an increase in caries more than beclamethasone inhaler but less than salbutamol inhaler. This can be attributed to its systemic effect on the salivary secretions. It could be due to its local effects of decreased pH and altered salivary secretion levels and salivary composition (N.DShashikiran et al, 2007). Stensson et al. also indicated that preschool children with asthma have a higher prevalence of caries than children without asthma. Factors leading to this may be due to a higher intake of sugary drinks and mouth breathing (Malin et al, 2011). Ryberg et al. stated that asthmatics treated with beta-2 agonists had a significant decrease in salivary secretion rate and in the concentrations of total protein and amylase and increase in Lactobacilli and Streptococcus mutans. This diminished flow rate can jeopardize the protective ability of the saliva to clear the oral cavity of fermentable substances and also decrease its buffering capacity (M Ryberg et al, 1987).

Besides indirect side effects of asthma medications such as decreasing the salivary flow rate or saliva pH, fermentable carbohydrates present in asthma medications may also increase the risk for dental caries (Sultan and Nasibe, 2016). Some dry powder inhalers contain sugar (lactose monohydrate) so that the patient can tolerate the taste of the drug when it is delivered. Frequent oral inhalation of these sugar-containing drugs, combined with a decrease in the salivary flow rate may contribute to an increased risk of caries. Frequent consumption of cariogenic drinks due to excessive thirst can also be a reason for an increase in the caries rate in asthmatics. The increase in the intake of these drinks may be related to a number of factors: an attempt to wash away the taste of the inhaled medication; to counter the desiccating effect of mouth breathing and the reduction in the salivary flow caused by beta-2 agonist (Thomas et al, 2010).

Individuals with medical problems and those considered to be at high risk for dental caries need special care and should be checked in less than 6 months. Parents should be incorporated into oral hygiene education of their children and, tooth brushing in preschool children should be performed under parental supervision. Patients should be informed about rinsing their mouth out after each use of the inhaler and also be recommended to use fluoride-containing mouthwash after brushing (Sultan and Nasibe, 2016).

Asthma and Dental Erosion

Sources of acid causing dental erosion may be threefold. Firstly, higher consumption of acid soft drinks by thirsty asthmatics. Secondly, the acidity of medications is less than pH 5.5. Thirdly, intrinsic acid from gastro-oesophageal reflux (GOR) (K Sivasthamparam et al, 2002). Asthma medication can place the patient at a risk of dental erosion by reducing salivary protection against extrinsic or intrinsic acids (Thomas et al, 2010).Saliva is considered to be one of the main neutralizing factors in the pathogenesis of dental erosion (YH Al-Dlaigan et al, 2002).The oral clearance of dietary acid is related to the rate of secretion and buffering capacity of saliva (Thomas et al, 2010). As mentioned earlier, studies have shown a lowered salivary flow rate in asthmatic subjects treated with beta-2 adrenoceptor agonists when compared to non-asthmatic groups (M Ryberg et al, 1987).This reduction in the production of saliva can affect the natural way in which the mouth maintains its chemical balance. There can be an increased dryness of the mouth in asthmatics due to the effects of bronchodilators and/or mouth breathing. So it is possible that there will be an increase in the consumption of drinks to compensate oral dehydration (Thomas et al, 2010).Thus, the most consistent highest risk dietary factors related to erosion were the consumption of soft drinks, carbonated beverages and sport drinks (YH Al-Dlaigan et al, 2002).

There is evidence that medicines taken by a dry powder inhaler may cause tooth erosion by changing the chemical environment of the mouth. O’Sullivan et al. showed that the pH of the powdered and aerosol forms differed significantly with almost all drugs having a pH of < 5.5 in the powdered form. Tooth substance begins to dissolve at pH 5.5. When used several times a day these drugs may contribute to the dissolution of enamel surfaces of the teeth that they contact (Elizabeth and Martin, 1998). Even though, in a study by Tootla et al., none of the inhalers demonstrated a clinically significant acidogenic response, a drop in salivary pH and plaque pH was observed with a lactose-based dry powder inhaler. When used several times a day, these drugs may contribute to the dissolution of teeth (RTootla et al, 2004).
Gastroesophageal reflux (GER) is also a potential trigger of asthma. The prevalence of gastroesophageal reflux disease in patients with asthma has been reported to range from 47 to 64% in children and from 33 to 90% in adults depending on the diagnostic parameters used to define gastroesophageal reflux (YH Al-Dliaian et al., 2002). The prevalence of reflux symptoms, esophagitis, and abnormal esophageal acid contact time is higher in patients with asthma than in control populations. Potential mechanisms, whereby asthma may predispose to the development of GER, include autonomic dysregulation, an increased pressure gradient differential between the thorax and the abdomen, a high prevalence of hiatal hernia, alterations in crural diaphragm function, and bronchodilator medication use (Susan, 2001).

As increasing numbers of children are using the powdered form of drugs, doctors should advise children to rinse their mouths with water directly after taking the drugs. The use of a spacer device may also be of benefit in delivering the dose to the back of the mouth. Children should also be encouraged to clean their teeth thoroughly at least twice a day with a fluoride toothpaste. This would help to prevent dental erosion, which may cause considerable sensitivity and is both costly and time consuming to treat (Elizabeth and Martin, 1998).

Asthma and Periodontal Disease

Periodontal disease has been known as an inflammatory disease with a reaction to bacterial plaque causing chronic inflammation, gingival bleeding, increased pocket depth, and ultimately, alveolar bone loss. In fact, bacterial antigens irritate the immune response of the host leading to the effects of the disease. The main factor in diminishing the periodontal disease is the interaction between bacterial and immunological factors. The biologic plausibility linking periodontal infection and severe asthma seem to be related to immunologic components common to both diseases that affect epithelial integrity, in both periodontal and respiratory tissue. The tissue breakdown present in periodontitis results, for the most part, from the actions of the immune system and of the related mechanisms. Similarly, bronchial inflammation is the result of complex interactions among inflammatory cells, chemical mediators, and the structural cells of the airways. Of these immunologic components, matrix metalloproteinases stand out. They are responsible for the breakdown of collagen and are found at elevated levels during the periodontal breakdown process. In the same way, these enzymes are also associated with bronchial remodelling in individuals with severe asthma (Vinay et al., 2017). An association between asthma and periodontal disease may involve either pathological activation of the immune or inflammatory process, the side effect of the asthma medications, or the interaction between the two (Thomas et al., 2010). Hyyppä indicated that higher concentrations of IgE may be present in gingival tissue of periodontitis patients than in that of healthy controls. Also, patients with asthma showed elevated values of IgE in the gingival tissue (Tuula, 1984).

McDeera et al.,Watman S et al. have reported that children with asthma had significantly more calculus and this was in association with the increase in salivary calcium and phosphorous in children with these diseases. Inhaled corticosteroids (ICS) may be absorbed into the systemic circulation, either through the lungs or by the swallowing of drugs that are not inhaled but are deposited at the back of the throat. Studies show that ICS can cause a decrease in bone mineral density (Thomas et al., 2010). Hanania et al. in their study showed that regular use of conventional doses of ICS by patients with asthma can suppress the adrenal function and decrease bone density in a dose-related fashion (Nicola et al., 1995). In a study by Han et al., tooth loss in asthma patients undergoing long-term treatment with a topically potent ICS was found to be related to a decrease in bone mineral density, especially in the mandible. Therefore, patients using these types of ICS should have their mandibular bone mineral density checked regularly, especially if they have any risk factors for osteoporosis. In addition, it would be wise for such patients to reduce their ICS dose (Eui-Ryoung et al., 2009).

The anti-asthmatic medication has its effects on periodontal status, but these can be taken care of by prophylactic treatment - which is beneficial to the patient considering the severity of the asthmatic disease and the necessity of medication during life-threatening episodes. Asthmatic patients are recommended to adopt more precautionary oral hygiene practices and keep their caries activity and periodontal health under constant check (N.DShashikiran et al, 2007).

Asthma and Oral Candidiasis

Oropharyngeal candidiasis is a condition commonly associated with the use of nebulized corticosteroids (Thomas et al., 2010). These side effects occur due to the deposition of the drug in the oropharynx. The incidence of oral candidiasis has varied from 1% to 77% with ICS treatment probably because of the method which is used to detect it. It showed that ICSs increase oropharyngeal Candida colonization in higher doses of the drug (E Kurt et al., 2008). Generalized immunosuppressive and anti-inflammatory effects of steroids are thought to play a major role in the pathogenesis of candidiasis. A study by Fukushima et al. suggested that inhaled corticosteroids can potentially decrease salivary total IgA but that host factors are also important in the development of oral candidiasis (Chizu et al., 2005). High concentrations of glucose related with lactose monohydrate present in the dry powder corticosteroids lead to candida growth, proliferation and adherence to oral mucosal cells. Additionally, dry mouth caused by β-2 agonists is also a key factor in the progression of candidiasis.

Mouth rinsing after the use of dry powder is recommended in order to prevent oral candidiasis. A spacer attached to the inhaler obviates medication to be deposited on the oropharynx and also facilitates an increase in medication concentration in the lungs. Chewing sugar-free gum as well as use of sialogogues may be recommended to avoid dry mouth which has an impact on the progression of candidiasis. Controlled use of topical antymycotics, such as nystatin may also be effective against oral candidiasis (Sultan and Nasibe, 2016).

CONCLUSION

The prevalence of asthma in the world and in our country has reached to a considerable level, however, it has a tendency to increase in our population. Impacts of the asthma medications on oral health have been suggested in several studies. Dental practitioners and pediatricians should be aware of the correlation.
between asthma and oral health. They should have knowledge about the impacts of these medications on oral health and should educate their patients about the measures that might be taken. Especially, for patients who do not maintain regular dental visits, dental consultation directed by pediatricians is of importance with regard to protect oral health.

**Dental practitioner recommendations for asthmatic patients can be listed as follows**

- Asthmatic individuals are in the group of people who are in need for special care and, thereby, dental visit frequency can be increased.
- Asthmatic children and their parents should be informed about the impacts of the asthma medications on oral health.
- Patients should be informed that they should rinse their mouth thoroughly with mouthwashes with a neutral pH, or sodium bicarbonate, milk or neutral sodium fluoride containing solutions after the use of inhaler,
- Measuring bone mineral density can be recommended for patients using inhaled corticosteroids,
- A spacer can be added to the inhaler in order to decrease the deposition of the medication in the mouth.

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