Original Article

Oral Health Status of Patients with Bronchial Asthma Reporting to a Tertiary Health Care Centre: A Cross-sectional Study

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Abstract

Background. Bronchial asthma is one of the growing public health problems around the world including India. In addition to its effects on general health, asthma has been reported to cause poor oral health.

Methods. Two hundred and seventy-seven patients with asthma were evaluated for dentition status, periodontal status, loss of attachment, dental erosion and xerostomia. Demographic details, oral hygiene practices and details pertaining to duration of the disease, medications of all the study patients were recorded by direct face-to-face interview and type of medication was obtained from medical records.

Results. A statistically significant difference was found for all the outcome variables with duration of the disease and medication. However, no such difference could be established with various drug combinations.

Conclusion. The results of the present study advocates relationship between asthma and oral health status.
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Key words: Oral health, Asthma, Anti-asthmatic medications, Hygiene.

Introduction

Asthma is the most common chronic disease in childhood and is also notable public health problem in adult populace[1] affecting 300 million worldwide and an additional 100 million are estimated to be diagnosed with asthma by 2025.[2] As the prevalence of asthma escalates in the population, it is necessary to examine how this disease affects other areas of health-care, most noticeably oral health.[3] Patients with bronchial asthma are affected both by the disease and the drug.[4] A link between oral diseases and commonly used anti-asthma inhalant medications has biological credibility.[5] Asthma is frequently treated with beta-adrenoceptors agonists that have a strong impact on saliva composition and quantity.[2] A growing body of evidence from epidemiological and clinical studies suggest that oral diseases (*e.g.*, periodontal disease, dental caries, dental erosion, and oral candidiasis) are associated with asthma and anti-asthmatic inhalant medications.[6] The factors, such as flow, composition, and pH of saliva in persons with asthma might be influenced by the medications or the disease itself[1] and may lead to an increased risk of dental caries1 and periodontal disease.[7,8]

Although the pathophysiology of the disease is well understood, yet the association of asthma with oral diseases and conditions has been a subject of debate among dental practitioners. The primary objective of the study was to assess the oral hygiene status, dental caries experience, periodontal status and dental erosion among asthmatic outpatients attending a Tertiary Care Centre in North India (Ambala) with special attention to the duration of asthma and anti-asthmatic medications along with type of medications.

Material and Methods

A cross-sectional study was conducted in the Department of Respiratory Medicine of a tertiary care centre for a period of 10 months (November 2014 to August 2015) after obtaining ethics clearance and conforming to STROBE Statement.[9]

The sample size was estimated to be 206 using OpenEpi, Version 3, open source calculator—SSPropor[10] at 99.9% confidence interval with population size N (for finite population correction factor or fpc) as 1000000 and hypothesised % frequency of outcome factor in the population (p) as 5% ± 5. To compensate for the possible losses due to incomplete recording of formats 10% of the estimated sample was added and a total of 227 subjects were included in the study. All the potential participants were identified by the respiratory medicine specialist using Global Initiative for Asthma (GINA)-2014 guidelines.[11] Patients who were 18 years or above, with a diagnosis of asthma and on anti-asthmatic medications for more than a year, free from any other systemic diseases/conditions and gave written consent were included in the study. The specialist selected

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the first asthmatic patient of the day who fulfilled inclusion criteria was included followed by inclusion of every alternate patient in the study sample. An inclusion criteria checklist was displayed in the working area of specialist to ensure unambiguous selection of the subjects. The selected cases were examined by principal investigator and data was recorded by a trained recorder in a self-structured proforma. Demographic details, habits, oral hygiene practices along with history of asthma and the medication consumed were recorded by direct interview. The literacy level was assessed by level of education as per Census 2011, Government of India[12], subjects were categorised in to socio-economic classes[13] and occupational divisions.[14] Type III Dental Examination[15] (in natural daylight with no.5 plain mouth mirror and WHO probe) procedure was carried out using a head torch for adequate illumination. Oral hygiene status was assessed using Simplified Oral hygiene Index[16] (OHI-S), dental caries experience was assessed using dentition status,[16] afterwards Decayed Missing and Filled Teeth (DMFT) scores were deduced from it and periodontal status was assessed using modified Community Periodontal Index (CPI)[17] and Loss of attachment[17] (LOA) along with dental erosion.[17] Xerostomia was assessed using tongue blade test.[18] A calibration exercise for all the outcome measures and inter- and intra-examiner consistency was assessed using kappa statistic[17] for OHI-S, dentition status, CPI modified, loss of attachment and dental erosion. Subjects were given chair side health education and those in need of treatment were referred to dental institute. Infection control measures were followed throughout the study and waste generated during the course of the study was handled in accordance with Biomedical Waste (Management & Handling) Rules,1998 of India.[19]

Statistical Analysis

The data so collected was entered on Microsoft Excel sheet (Version 14.4.7) and analysed using Statistical Package for the Social Sciences (SPSS, version 20.0 [Chicago, USA]).[20] A confidence interval of 95% and significance level of 5% ($p<0.05$) were established for all the statistical tests used. The sample was stratified by the duration of asthma and the medication (1-5 years, 6-10 years, 11-15 years, 16-20 years and >20 years). Xerostomia was expressed as percentage of subjects in each sub-category and Chi-square test was used to compare the proportions in each group. Simplified oral hygiene index scores were expressed as mean ± standard deviation. Caries experience, and modified CPI Scores for each sub-group were expressed in terms of mean ± SD and analysis of variance (ANOVA) was used for the comparison of the same in various sub-groups. Loss of attachment scores were expressed as percentage by highest scores and dental erosion as percentage of subjects by severity of erosive lesions. Chi-square test was used for comparing the same in sub-groups. A total of 10 drug combinations were encountered during the study but to ascertain the statistical significance three combinations with maximum frequency were selected for final comparisons.

Results

A total of 227 subjects were included in the final analysis. Their age ranged from 18 to 65 years with a mean age of 45.0±13.0 years and among total sample examined, 53.3% (121) were females and 46.6% (106) were males. The mean duration of asthma among the subjects is 15.9±13.3 years with a mean duration of the medication of 12.2±10.5 years. Descriptive statistics of the study sample are shown in table 1. During calibration exercise, the inter- and intra-examiner consistency assessed by kappa statistic was found to be κ=0.88, κ=0.80, κ=0.79, κ=0.77 and κ=0.82 for OHI-S, dentition status, CPI modified, loss of attachment and dental erosion, respectively.

Table 1. Descriptive characteristics of the sample.

Characteristic	Number (%)
Duration of asthma (in years)	
1-5	60 (26.4)
6-10	51 (22.4)
11-15	32 (14.0)
16-20	36 (15.8)
>20	48 (21.1)
Duration of medications (in years)	
1-5	80 (35.2)
6-10	70 (30.8)
11-15	24 (10.6)
16-20	26 (11.4)
>20	27 (11.9)
Drug combinations	
Combination 1 (Bronchodilator+Coticosteroid Anti-histamine)	83 (36.6)
Combination 2 (Bronchodilator+Corticosteroid)	66 (29.1)
Combination 3 (Bronchodilator+Corticosteroid Systemic corticosteroid)	34 (15.0)

Xerostomia was present in 168 (74%) subjects and difference was statistically significant in relation to the duration of asthma and the medication (Tables 2 & 3). The DMFT, CPI modified and LOA scores with the duration of asthma and the medication are given in tables 2 and 3, respectively. The difference was statistically significant for both in all the sub-groups with p=0.00 (Tables 2 & 3). A statistically significant difference in LOA scores with the duration of asthma (p=0.003) and the duration of medication (p=0.04) was observed (Tables 2 & 3). The prevalence of dental erosion was found to be 77.5% with 39.2% (dentinal lesions), 31.8% (pulp involvement) and 28.90% (enamel lesions). The severity of erosive lesions differed significantly for duration of asthma (p=0.000, Table 2) and duration of the medications (p=0.05, Table 3). However, the difference was not significant statistically for various drug combinations (Table 4) with Xerostomia, DMFT, CPI modified, LOA and dental erosion ($p> 0.05$).

Table 2. Presence of xerostomia, mean DMFT, modified CPI and loss of attachment scores with duration of asthma.

	Duration of Asthma (in years)					p value
	1-5	6-10	11-15	16-20	>20	
Xerostomia						
Present	31.7% (19)	86.3% (44)	90.6% (29)	83.3% (30)	95.8% (46)	
Absent	68.3% (41)	33.3% (7)	10.3% (3)	16.7% (6)	4.2% (2)	0.000*
DMFT (Mean±SD)	10.6±6.1	14.0±6.4	13.7±6.6	14.3±7.7	20.1±5.9	0.000**
Community periodontal index–modified						
Gingival Bleeding						
Present	4.0±4.6	6.1±6.1	4.5±4.5	5.3±4.9	8.5±5.0	0.000**
Pocket (Pocket 4-5 mm)	1.7±2.5	1.8±2.6	2.3±2.8	1.3±1.7	2.7±2.9	0.002**
Loss of attachment						
Score 0 (0-3 mm)	65.0% (39)	62.7% (32)	75% (24)	52.8% (19)	38.8% (19)	
Score 1 (4-5 mm)	31.7% (19)	29.4% (15)	25.0% (8)	30.6% (11)	36.7% (18)	0.003*
Score 2 (6-8 mm)	3.3% (2)	7.8% (4)	0	16.7% (6)	22.9% (11)	
Dental erosion						
Enamel lesion	44.4% (16)	30% (12)	37.5% (9)	17.2% (5)	19.1% (9)	
Dentinal lesions	27.8% (10)	40% (16)	54.2% (13)	48.3% (14)	34.0% (16)	0.000*
Pupal involvement	27.8% (10)	30% (12)	8.3% (2)	34.5% (10)	46.8% (22)	

*Difference was statistically significant at 95% confidence limit (Chi-square)
**Difference was statistically significant at 95% confidence interval (ANOVA)
Definition of abbreviations: DMFT=Decayed missing and filled teeth; CPI=Community Periodontal Index; SD=Standard deviation

Table 3. Mean DMFT, modified CPI and loss of attachment scores with duration of medication.

	Duration of Medication (in years)					p value
	1-5	6-10	11-15	16-20	>20	
Xerostomia						
Present	42.5% (34)	58.6% (41)	54.2% (13)	92.3% (24)	92.6% (25)	0.000*
Absent	57.5% (46)	41.4% (29)	45.8% (11)	7.7% (2)	7.4% (2)	
DMFT (Mean±SD)	10.1±6.1	12.7±5.8	10.5±5.7	16.4±7.1	18.6±6.2	0.00**
Community periodontal index–modified						
Gingival Bleeding						
Present	4.5±5.1	6.0±5.6	6.1±5.1	4.4±4.3	9.3±4.5	0.001**
Pocket (Pocket 4-5 mm)	1.2±1.9	2.0±3.0	1.1±1.8	2.1±2.4	2.9±2.9	0.1
Loss of attachment						
Score 0 (0-3 mm)	63.8% (51)	58.6% (41)	54.2% (13)	73.1% (19)	33.3% (9)	
Score 1 (4-5 mm)	30% (24)	28.6% (20)	41.7% (10)	15.4% (4)	44.4% (12)	0.04*
Score 2 (6-8 mm)	6.2% (5)	12.9% (9)	4.1% (1)	11.5% (3)	22.2% (6)	
Dental erosion						
Enamel lesion	38.5% (20)	27.8% (15)	28.6% (6)	21.7% (5)	19.23% (5)	
Dentinal lesions	34.6% (18)	38.9% (21)	52.4% (12)	52.2% (12)	26.92% (7)	0.005*
Pupal involvement	26.9% (14)	33.3% (18)	19.0% (4)	26.1% (6)	53.85% (14)	

*Difference was statistically significant at 95% confidence limit (Chi-square)
**Difference was statistically significant at 95% confidence interval (ANOVA)
Definition of abbreviations: DMFT=Decayed missing and filled teeth; CPI=Community Periodontal Index; SD=Standard deviation

Table 4. Mean DMFT, community periodontal index–modified scores, loss of attachment and severity of dental erosion with various drug combinations.

	Drug Combinations			p value
	Combination 1 (Bronchodilator+ Corticosteroid and Antihistamine)	Combination 2 (Bronchodilator + Corticosteroid)	Combination 3 (Bronchodilator+ Corticosteroid and Systemic corticosteroid)	
Xerostomia				
Present	26.5% (22)	27.3% (18)	20.5% (7)	0.7#
Absent	73.5% (61)	72.7% (48)	79.4% (27)	
DMFT (Mean±SD)	13.2±7.0	13.7±6.5	12.7±8.7	0.7##
Community periodontal index–modified				
Gingival bleeding				
Present	5.0±4.8	5.6±4.8	5.9±6.2	0.6##
Pocket (Pocket 4-5 mm)	1.6±2.3	1.8±2.4	1.6±2.3	0.8##
Loss of attachment				
Score 0 (0-3 mm)	62.7% (52)	60.6% (40)	67.6% (23)	
Score 1 (4-5 mm)	26.5% (22)	28.8% (19)	29.4% (10)	
Score 2 (6-8 mm)	10.8% (9)	10.6% (7)	2.9% (1)	0.71#
Dental erosion				
No erosion	38.6% (32)	30.3% (20)	14.7% (5)	
Enamel lesion	15.7% (13)	24.2% (16)	26.5% (9)	0.8#
Dentinal lesions	22.9% (19)	25.8% (17)	32.4% (11)	
Pupal involvement	22.9% (19)	19.7% (13)	26.5% (9)	

Revealed by #Chi-square test, ## ANOVA
Definition of abbreviations: DMFT=Decayed missing and filled teeth; SD=Standard deviation

Discussion

Published literature on oral health in adults with asthma is sparse and have recorded large variations in terms of the age of the participants, the severity and duration of asthma and effect of asthma medication.[21] Among 227 subjects, 121 (53.3%) were females and 106 (46.6%) were males because in childhood asthma is more common in boys than girls but, in adults the gender distribution changes, the disease becoming more frequent in females.[5] High prevalence of xerostomia (74.1%) was reported in the present study that is at par with the results reported in the earlier studies.[22] In the present study, we observed an increase in xerostomia with an increase in duration of the drugs to control asthma, as reported in other studies.[23-25] Studies have reported that there is a decrease in flow rates of whole saliva and specifically parotid saliva in patients treated with beta-agonist inhalers by 26% and 36%, respectively.[4] Some authors have concluded that impaired salivary gland function in asthmatics is caused by the asthma medication and not asthma itself.[26] This could not be established in the present study as we have not investigated salivary gland function. Oral hygiene was estimated to be fair in 59.4% and poor in 39.3% of the sample which could be due to increased attention to their general asthmatic condition rather than oral hygiene[27] and intake of medication at night before retiring in bed is commonly seen due to poor patient awareness and also no oral hygiene measures taken after medication.[4] Increased prevalence of calculus in asthmatic patients is due to increased level of calcium and phosphorus in sub-maxillary and parotid saliva.[7] This study has reported an increase in the prevalence of dental caries and an increase in DMFT scores with an increase in duration of asthma and duration of medication. This is in agreement with other studies investigating caries in adult asthmatics.[3,28,29] Most of the studies published to date have provided inconclusive results, mainly due to limitations related to the size of the sample. Some of the studies have revealed negative results regarding the prevalence of dental caries in asthmatic population[5,26,30] but in these studies the population of interest were children, so increased prevalence of dental caries in the present study could be due to increased exposure to disease and medication. Although epidemiological evidence supporting the asthma–caries association is controversial, saliva plausibly plays a key role in biological or pharmacological interactions between the two conditions. The diminished flow rate of saliva also decreases the availability of biologically active anti-

bacterial components, like amylase, calcium ions, secretory immunoglobulin (Ig) A, peroxidase and lysozyme, which in turn favours bacterial colonisation and plaque growth leading to an increase in dental caries.[31] The results of the present study reveal that factors related to asthmatic condition and /or asthma medication might increase the risk of caries and subjects in the study had long-term exposure to disease as well as medication, therefore the scope to dissociate the effect of two factors was not possible. Results of the present study suggest that complex inflammatory disease may alter composition and amount of saliva, however, the role of other co-variates, such as oral hygiene practices, socio-economic level and educational qualification could not be ruled out.

We observed that asthmatics had gingival inflammation as assessed by gingival bleeding component of modified CPI index. This is in agreement with the other studies.[7,32,33] This could be explained by an altered immune response and dehydration of alveolar mucosa due to mouth breathing.[27] Studies examining the association between periodontal disease and asthma have reported varying results. Some studies revealed a poor periodontal health,[4,5,30] but others did not find any difference in the prevalence of periodontal disease in asthmatics.[26,34] There was a clear inverse relationship between gingival scores; pocket scores of modified CPI and socio-economic status that is in accordance with earlier studies.[35] Periodontal condition deteriorated as the duration of asthma and duration of medication increased that is evident with an increase in the prevalence of LOA score of 2 (6-8 mm) in the present study population which is similar to another study.[7] This may be due to the changes in immune functioning in asthma which may lead to periodontal destruction. A decrease in IgA levels has been reported in asthmatic patients.[26] As IgA acts as a first-line defense for mucosa and play an important role in restricting periodontal disease, its reduced levels in asthmatic patients may be associated with periodontal destruction.[7] The difference in the number, age, gender, socio-economic status, education, and severity of the disease may rationalise the discrepancies in the results of different studies. High prevalence of dental erosion (77.20%) was observed in the preset study population, which could be attributed to reduced salivary protection against intrinsic and extrinsic acids.[36] One explanation for erosion may be that dry powder inhalers have a low pH and sometimes contains lactose monohydrate as a carrier vehicle at a concentration of 12-25 mg per dose. This lactose monohydrate makes the inhaler self-acidic.[37] One of the studies have revealed that certain inhaled beta-2-adreno receptor drugs which are partly swallowed when used, may decrease the lower oesophageal sphincter pressure and the oesophageal contraction amplitude. The relaxation is associated with gastro-oesophageal regurgitation. The relationship between dental erosion and gastro-oesophageal regurgitation is well documented.[37] High prevalence of erosion can also have a dietary explanation as asthmatic patients due to mouth breathing or decreased salivation tend to consume carbonated drinks when water or juices not available to compensate oral dehydration.[38] Some of the studies have reported that asthmatic patients are at higher risk of developing dental erosion,[38,39] while another study found no clear association.[40]

Since, this is a cross-sectional study with a relatively smaller sample size, and proportions of subjects in each drug combination to be very less, no significant finding regarding the type of drug consumed could be established. However, an attempt was made to analyse the combinations with maximum frequency but the difference for all the outcome variables was not significant between the chosen ones. Further investigations with a larger sample size are needed to elucidate the relationship between the types of drugs consumed for the treatment. In this study, the other factors, such as composition of saliva and mouth breathing were not considered that might be potential confounding factors.

Conclusions

The present study has revealed deterioration in oral health status in relation to duration of asthma and duration of medication in patients with asthma. Further population-based research incorporating better defined co-variates and longitudinal designs is needed to characterise such a link successfully. Patients with asthma should be educated about their susceptibility to oral problems and should be encouraged to regular dental visits. Patient-centered inter-disciplinary coordinated care that includes both medical and dental professionals should be planned to ensure overall health and acceptable quality of life of asthma patients.

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