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ORIGINAL ARTICLE

Comparative Evaluation of Dental Caries in Asthmatic and Asthma-free Children: A Cross-sectional Study

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ABSTRACT

Aims and objectives: The aim of this study is to assess the prevalence of dental caries in asthmatic children of age group 5 to 16 years and to evaluate and compare the dental caries status among asthmatic and asthma-free children.

Materials and methods: A cross-sectional study was done on 200 children aged 5 to 16 years. The participants were divided into two groups. The study group included 100 asthmatic children/adolescent diagnosed with asthma attended the local hospitals. Asthma-free group composed of 100 asthma-free children/adolescents recruited in two public schools. The details on asthma severity were obtained from patient's records, by consulting the pediatrician treating these children or by interviewing their parents/caregivers. Dental caries status was assessed using DMFT and dmft indices. Chi-square and independent Student's t-test used for statistical analysis of data.

Results: The prevalence of dental caries in the asthmatic children, for permanent dentition was 28% and primary teeth caries experience was 67% and the result was statistically significant. Asthmatic children had a higher mean DMFT (0.54 ± 0.82)/dmft (2.74 ± 2.59) score. There was statistically significant difference existed for DMFT among five drug forms (chi-square = 60.437; p-value = 0.001). No significant differences were encountered in anti-asthmatic drugs and DMFT/dmft.

Conclusion: There is a high prevalence of dental caries in both permanent and deciduous teeth in asthmatic children. Children given beta 2 agonists, inhaler form of antiasthmatic medication are at a higher risk of developing caries in their teeth. Physicians and dentists should recommend preventive measures against caries for children with asthma.

Keywords: Antiasthmatic medication, Asthma, Dental caries, DMFT score, dmft score.

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INTRODUCTION

Dental caries is a multifactorial disease progress through a complex mechanism which includes demineralization of the enamel by mean of the organic acids produced by microorganisms in dental plaque.[1] Dental caries in India is consistently increasing in prevalence and severity, especially in children; today, according to number of investigators, 70 to 80% are suffering from this disease.[2] The prevalence of caries is still high, even in developed countries, and caries is the most common chronic health problem affecting children.[3] After dental caries, asthma appears to be the most prevalent chronic childhood disease, considered to be a serious global health problem.[4,5] According to global initiative for asthma (GINA) 2008, asthma is a chronic inflammatory disorder of the airways in which many cells and cellular elements play a role. The chronic inflammation is associated with airway hyperresponsiveness that leads to recurrent episodes of wheezing, breathlessness, chest tightness, and coughing, particularly at night or in the early morning.[6] Asthma has a worldwide prevalence rate of 2 to 33% in childhood.[7] Worldwide, approximately 300 million people of all ages are affected by the disease.[8] In India, about 15 to 20 million people are suffering from asthma.[9] The treatment of asthma starts with avoidance to stimuli, however, controlling the symptoms with antiasthmatic medicines is the main component of most asthma treatments.[10] There are various reasons why asthma may cause an increase in caries risk. Reduced salivary flow rate in asthmatic children is accompanied by a concomitant increase in cariogenic microorganisms, lactobacilli and *Streptococcus mutans* in the oral cavity, which are contributing factors for higher caries rates.[11] It has been demonstrated that asthmatic children consume sugary drinks more often than non-asthmatic children.[12,13] Antiasthmatic medications may also decrease the pH of plaque and saliva, which would make conditions more favorable for caries development. It has also been reported that some inhalers may contain fermentable carbohydrate, such as lactose monohydrate and oral medications in syrup form may contain sugars, this can increase the risk of dental caries.[14]

Fig. 1: Armamentarium

Fig. 2: Examination of the subject at school

Hence, the study was conducted to assess the prevalence of dental caries in asthmatic children of age group 5 to 16 years and to evaluate and compare the dental caries status among asthmatic and asthma-free children.

MATERIALS AND METHODS

This study was planned in the Department of Pedodontics and Preventive Dentistry, Rungta College of Dental Sciences and Research, Bhilai, to assess the prevalence of dental caries in asthmatic children of age group 5 to 16 years and then evaluate and compare the dental caries status among asthmatic and asthma-free children. The study proposal was approved by the institutional ethics committee. hundred total of 200 children aged 5 to 16 years from Raipur region, India, were enrolled in the study. The participants were divided into two groups. Group I - the study group included 100 children diagnosed with asthma attending the various local children hospitals and clinics: Ekta Child Hospital, The Children's Clinic, Well Baby Clinic in Raipur region of Chhattisgarh state. Prior consent was obtained from the respective hospital authorities to conduct the study. Group II consisted of 100 children selected from Sarvodaya Higher Secondary School, Bhawani English Medium School, Raipur. Prior to the study, informed parental consent for the child's participation was obtained.

The inclusion criteria were as follows: Children in age group of 5 to 16 years and medical diagnosis of asthma confirmed by pediatrician. The exclusion criteria were as follows: Presence of any other systemic disease and deformity, such as physically handicapped and mentally challenged children, presence of any orthodontic appliance, and children who had taken antibiotics within the month prior to the study.

The following instruments and materials were used in this study: Plain mouth mirror, WHO probe, tweezer, kidney tray, cotton rolls, cotton holder, disposable mouth masks, sterile gloves, dettol (disinfectant), dermafilm hand sanitizer, and enamel tray (Fig. 1).

For control group clinical examination was carried out in the institute's medical room or classroom under artificial light. Children were seated in an ordinary chair in an upright position. A sterile mouth mirror and ball-ended dental probe were used to examine each child and to record the DMFT and dmft index scores (Fig. 2).

For asthma group, general questionnaire/information related to personal, medical, and dental history was recorded for all the children with the assistance of their parents or legal guardians. The children were examined at the hospital outpatient department, seated on an ordinary chair in an upright position. The teeth were examined under artificial light and DMFT and dmft score were recorded. All examinations were conducted by a single trained examiner and an assistant assisted the examiner in the survey (Fig. 3).

The data collected in the pro forma was then entered into Microsoft Excel spreadsheet, which was then transferred to Statistical Package for the Social Sciences 16.0

Fig. 3: Examination of the subject at hospital

IBM for statistical analysis. Then continuous data summarized as mean and standard deviation whereas discrete data expressed as in numbers. Descriptive statistics used to describe the sample subset. Chi-square analysis was used to analyze data in contingency tables. Independent Student's t-test was used to analyze for statistically significant difference amongst the mean. Confidence interval was kept at 95% and p-value less than 0.05 was considered statistical significant.

RESULTS

A total of 200 children aged 5 to 16 years were examined in this study, of which 59 were male whereas 41 were female in the study group and in control group, 54 were male and 46 were female. Among 100 asthmatic children, there were 61 children from the age group 5 to 10 years and 39 from 11 to 16 years, whereas among the asthma-free children, 56 were from the age group 5 to 10 years and 54 were from the age group 11 to 16 years. When nean DMFT/dmft was calculated from asthmatic and asthma-free children, the asthmatic children had a higher mean DMFT/dmft score (0.54 ± 0.82/2.74 ± 2.59) when compared to asthma-free children. When t test was applied, this difference was found to be statistically significant for permanent teeth (t = 2.230; p-value = 0.027) as well as deciduous teeth (t = 4.631; p-value = 0.001) (Tables 1 and 2).

In this study, asthma was categorized based on its severity as intermittent, mild persistent, moderate persistent, and severe persistent. When dental caries status DMF was assessed based on this asthma severity, a higher percentage of children suffering from moderate persistent asthma, had decayed teeth (D) and filled teeth (F), and the similar result was found when dental caries status dmf was assessed based on this asthma severity, a higher percentage of children suffering from moderate persistent asthma, had decayed teeth (D), missing (M), and filled teeth (F) (Tables 3 and 4).

In this study, asthmatic children were under medication viz. syrup, tablet, inhaler, syrup and tablet, syrup and inhaler. We tried to assess whatever DMFT score varied among the different drug form. Chi-square analysis showed that the statistically significant difference existed for DMFT among the above five drug forms (chi-square = 60.437; p-value = 0.001) (Table 5), however, not statistically significant difference existed for dmft among the above five drug forms (chi-square = 34.504; p-value = 0.716) (Table 6).

The choices of drugs for treating asthma were beta 2 agonists, steroids, and their combinations. In this study, it was assessed whether DMFT/dmft varied with these three prototypes. Chi-square test revealed that there was no statistically significant difference amongst the above three (for DMFT, p-value = 0.135 and for dmft, p-value = 0.795) (Tables 7 and 8).

The results of this study show that there is a high prevalence of dental caries in both permanent and deciduous

Table 1: Comparison of dental caries status (DMFT) in asthma-free and asthmatic children

Group	*DMFT (Mean ± SD)*	*t-value*	*p-value*	*Significance*
Asthma-free	0.26 ± 0.94	2.230	0.027*	Statistically significant
Asthma	0.54 ± 0.82			

Statistical test: Independent t-test; (p ≤ 0.05 – significant, CI = 95%)

Table 2: Comparison of dental caries status (dmft) in asthma-free and asthmatic children

Group	*dmft (Mean ± SD)*	*t-value*	*p-value*	*Significance*
Asthma free	1.35 ± 1.51	4.631	0.001*	Statistically significant
Asthma	2.74 ± 2.59			

Statistical test: Independent t-test; (p ≤ 0.05 – significant, CI = 95%)

Table 3: Describes DMFT based on asthma severity in asthmatic children

Status	*Intermittent*	*Mild persistent*	*Moderate persistent*	*Severe persistent*
Decayed (%)	3	5	13	7
Missing (%)	0	0	0	0
Filled (%)	2	2	8	2

Table 4: Describes dmft based on asthma severity in asthmatic children

Status	*Intermittent*	*Mild persistent*	*Moderate persistent*	*Severe persistent*
Decayed (%)	2	13	44	8
Missing (%)	0	5	21	1
Filled (%)	0	1	2	0

Table 5: Dental caries status (DMFT) in asthmatic children based on drug form

Group	*DMF = 0*	*DMF > 0*	*Chi-square*	*p-value*	*Significance*
Syrup	10	6	60.437	0.001	Statistically significant
Tablet	3	0			
Inhaler	35	16			
Syrup and Tablet	0	2			
Syrup and Inhaler	13	15			

(p ≤ 0.05 – significant, CI = 95%)

Table 6: Dental caries status (dmft) in asthmatic children based on drug form

Group	*dmf = 0*	*dmf > 0*	*Chi-square*	*p-value*	*Significance*
Syrup	9	7	34.504	0.716	Not statistically significant
Tablet	2	1			
Inhaler	12	39			
Syrup and Tablet	2	0			
Syrup and Inhaler	6	22			

(p ≤ 0.05 – significant, CI = 95%)

Table 7: DMFT in asthmatic children based on drug consumed

Group	*DMF = 0*	*DMF > 0*	*Chi-square*	*p-value*	*Significance*
Beta-2 agonists	47	24	9.773	0.135	Not statistically significant
Steroids	9	6			
Combination	5	9			

(p ≤ 0.05 – significant, CI = 95%)

Table 8: dmft in asthmatic children based on drug consumed

Group	*dmf = 0*	*Dmf > 0*	*Chi-square*	*p-value*	*Significance*
Beta-2 agonists	24	47	14.672	0.795	Not statistically significant
Steroids	4	11			
Combination	3	11			

(p ≤ 0.05 – significant, CI = 95%)

teeth in asthmatic children in the surveyed population. When evaluated and compared the dental caries status among asthmatic and asthma-free children, it was found that the asthmatic children had a higher mean DMFT/dmft score when compared to asthma-free children, and the difference between the two groups was statistically significant.

DISCUSSION

Human body is affected by many systemic diseases; of which asthma is one of the serious health problems affecting more than 100 million people worldwide. Pediatric asthma is a serious global health problem. It accounts for a large number of lost school days.[9] The prevalence of asthma has been increasing since the 1980s across all ages, gender, and racial groups and is higher among children than adults. Asthma and tooth decay are the two major causes of school absenteeism.[15] Asthma treatment has two main objectives: To control, as well as to reduce the airway inflammation, and reopen the airways. The treatment of asthma starts with avoidance of stimuli, however, controlling the symptoms with antiasthmatic medicines is the main component of most asthma treatments.[10]

In this study, a close relationship has been found between the oral and systemic condition which is emphasized by this findings that children with systemic diseases, such as asthma had significantly higher prevalence of dental caries than the healthy children.

In this study, out of the 100 asthmatic children, (59%) were males, whereas (41%) were females and in asthma-free children, 54 were males and 46 were females, means there was lower proportion of female subjects and considerable high proportion of male subject was present. Majority of asthmatic children belonged to 5 to 10 years (61%) followed by 11 to 16 years (39%). Similar findings were reported by Jayakumar et al[16] in Bangalore city. Kirstila et al[17] reported female preponderance, which was attributed to the fact that living in ill-ventilated houses, use of cow-dung cakes and agriculture waste as fuel for cooking and girls always helping the mothers to cook in the kitchen lead to airway inflammation and asthma.

In this study, the asthmatic children had a higher mean DMFT/dmft score when compared to asthma-free children and the difference was found to be statistically significant. Similar study findings were by Khalilzadeh et al[18] which showed higher (mean ± SD) DMFT (3.3 ± 2.8) in asthmatics children as compared to the healthy controls. The possible cause of an increase in caries prevalence among asthmatic patients has been related to the use of beta 2-agonists in the treatment of asthma which leads to a reduction in the salivary flow. Stensson et al,[19] Shashikiran et al,[20] and McDerra et al[21] do not demonstrate a positive association between asthma and dental caries.

GINA has subdivided asthma by severity, based on the level of symptoms, airflow limitation, and lung function variability, into four categories: Intermittent, mild persistent, moderate persistent, or severe persistent (Table 9). Classification of asthma by the severity of symptoms is

Table 9: Classification of asthma severity by clinical features before treatment

Intermittent	Symptoms less than once a week Brief exacerbations Nocturnal symptoms not more than twice a month • FEV1 or PEF ≥ 80% predicted • PEF or FEV1 variability < 20%
Mild persistent	Symptoms more than once a week but less than once a day Exacerbations may affect activity and sleep Nocturnal symptoms more than twice a month • FEV1 or PEF ≥ 80% predicted • PEF or FEV1 variability < 20 – 30%
Moderate persistent	Symptoms daily Exacerbations may affect activity and sleep Nocturnal symptoms more than once a week Daily use of inhaled short-acting _2-agonist • FEV1 or PEF 60-80% predicted • PEF or FEV1 variability > 30%
Severe persistent	Symptoms daily Frequent exacerbations Frequent nocturnal asthma symptoms Limitation of physical activities • FEV1 or PEF ≤ 60% predicted • PEF or FEV1 variability > 30%

FEV: Force vital capcity; PEF: Peak expiratory flow

useful when decisions are being made about management at the initial assessment of a patient. Severity is not an invariable feature of an individual patient's asthma, however, may change over months or years.[6]

In this study, when dental caries status DMF/dmft was assessed based on this asthma severity, a higher percentage of children suffering from moderate persistent asthma had decayed teeth whereas only a few percentage of children in severe persistent asthma category had decayed teeth. Similar findings had been reported by Anandhan et al,[2] Stensson et al),[8] and Anjomshoaa et al.[22] The increase in caries prevalence with the severity of asthma may be mainly due to the increase in the dosage and frequency of medication.[20]

In this study, it was seen that among the asthmatic children having decayed teeth, the more number of asthmatic children with decayed teeth were affected by using inhaler form of drug followed by combination of syrup and inhaler, syrup. Similar type of finding was seen in the study conducted by Reddy et al,[23] where (mean ± SD) DMFT was found to be more in the asthmatic children using inhalers. The more number of asthmatic children with decayed teeth were affected by using inhaler form of drug, therefore, this might be attributed to long- term consumption of inhalers which contains fermentable carbohydrates, such as lactose monohydrate to improve the taste of the drug, and thus the tolerance of the patient to the same. Frequent consumption of these inhalers in combination with reduced secretion of saliva has a further negative effect of these drugs or increases the risk of caries.

Asthma is treated using many types of drugs. In this study, the choice of drugs for treating asthma were beta 2 agonists, steroids, and their combinations. In this study, it was assessed whether DMFT/dmft varied with these three prototypes. Results revealed that there was no statistically significant difference amongst the above three. However, the (mean ± SD) DMFT/dmft was more in beta 2 agonist than the steroids and combination of beta 2 agonist and steroids, however, not statistically significant. Findings were in agreement with the study conducted by Hamid et al.[24]

The secretion rates of whole and parotid saliva is decreased by 26 and 36% respectively in asthmatic patients when compared with healthy control group. As reduced salivary flow is accompanied by concomitant increase in lactobacilli and *streptococcus mutans* in the oral cavity, it may be one of the major contributing factors for increase in caries rate. The intake of medication at night before retiring to bed is commonly seen due to poor patient awareness and also no oral hygiene measures were usually taken after medication. Diminution of salivation and lack of masticatory movements during the night might have further increased the cariogenic potential of medicines.

Suggestions

- Preventive measures, such as promoting oral hygiene practices that include proper tooth brushing after every meal and use of dental floss at least once a day.
- Encourage regular periodic dental check-ups for children who are at high risk of developing dental caries.
- Institute dietary modification that includes restriction of sugary foods or drinks between meals, avoiding refined carbohydrates and consuming food rich in starch and fiber.
- Instruct the patients to adequately rinse the mouth with neutral pH or basic mouth rinses (milk, water, sodium fluoride 0.05% mouth rinses) immediately after using an inhaler especially before bedtime.
- Recommend the use of antimicrobial mouth rinses, such as chlorhexidine gluconate mouth rinses (0.12%).
- Insist on use of inhalers with a spacer device to reduce the medication deposits in the oral cavity and oropharynx.
- Recommend professional application of pit and fissure sealants, and fluoride varnishes and gels.

CONCLUSION

The results of this study have shown that patients living with asthma experience have higher dental caries. These findings suggest that the oral health assessment made was utilized to provide sufficient data to the consulting

pediatrician to be aware of oral disease burden of asthmatic children. This would help to develop a need-based treatment protocol in asthma management so that due consideration is given to oral health while treating these asthmatic children. Asthmatic patients are recommended to adopt more precautionary oral hygiene practices and keep their caries activity under constant check.

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