Periodontal Status in Patients With Asthma-a Case Control Study

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Abstract

The present study was to determine the prevalence of periodontal disease in patients with and without asthma and to correlate the severity of periodontal disease to the severity of asthma in patients with asthma. A case control study was conducted on 100 subjects who visited the Department of Pulmonary Medicine KMC and the Department of Periodontology, MCODS Mangalore.Subjects were divided into two groups: group1(50 asthmatics) and group2(50 nonasthmatics). Each patients underwent Lung function test and periodontal examination(OHI-S,GI,PD and CAL) and the values thus obtained were statistically analyzed. Results had shown the prevalence of periodontal disease was 96% in asthmatics and 78% in nonasthmatics. Significant difference was found between the two groups in terms of OHI-S, PD and CAL($P<0.001$), whereas no significant difference was found in GI scores. Patients using only inhalational medication had high odds of getting mild periodontitis. A positive correlation between asthma and periodontal disease was noted. It was also observed that, the type of medication taken by asthmatics influences the severity of periodontitis and not the severity of asthma.

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Introduction

Periodontal disease is a highly prevalent chronic disorder which affects about 90% of the world population[1]. The susceptible individuals may exhibit greater expression of local and systemic mediators and may thereby be at increased risk of developing a disease. In recent years there is an increase in research evidence suggesting associations between periodontal disease and increased risk of systemic diseases such as atherosclerosis, diabetes mellitus, respiratory diseases, myocardial infarction and adverse pregnancy outcomes[2,3,4,5,6]. So far a causal relationship has been established between periodontal disease and diabetes mellitus, however, only a casual relationship is documented with other systemic diseases[7,8]. Among the respiratory diseases, asthma is one of such diseases which is growing public health problem affecting over 300 million people world-wide and by 2025 additionally 100 million may be diagnosed with asthma[9].

In 2016, approximately 8.3% of children in the United States had asthma.It is estimated that 15 to 20 million people are suffering from bronchial asthma in India[10].

Few studies have been conducted on prevalence of periodontal disease in patients with asthma, among them few establishing causal relationship between the two and some which have failed to find any such association. Hence the present case control study was an effort in the direction to find out the correlation between asthma and periodontal disease by using both questionnaire and Lung function test (LFT) values for diagnosing asthma and compared the severity of both diseases.

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Materials and methods

This is a case control study conducted to

assess the prevalence of periodontal disease in patients with asthma. It was conducted between January 2017 to April 2018.

Study subjects: One hundred patients (50 patients with asthma and 50 patients without asthma) who visited the Department of Pulmonary Medicine Kasturba Medical College,Mangalore, Attavar and the Department of Periodontology, Manipal College of Dental Sciences Mangalore were recruited in the study. One hundred and seventy five patients were screened for the eligibility criteria, to reach the sample of 100.

This was a double blinded study; wherein;the periodontist (H) who recorded the periodontal parameters was blinded to the lung function test (LFT) values and was unaware of the asthmatic status of the patients. Similarly, the presence of periodontal disease was unknown to the person performing the LFT.

Allotment of study subjects is as shown in the flow diagram (figure.1)

Figure 1. Study subjects is as shown in the flow diagram.

Patients were recruited based on the inclusion and exclusion criteria as follows: Patient aged 18-60yrs with at least 20 natural teeth who have not been on antibiotics systemically or topically during the last 3 months and suffering from intermittent, mild to severe persistent asthma as diagnosed on clinical and pulmonary function test criterion were included in the study. On the other hand patients with uncontrolled diabetes, uncontrolled hypertension and other respiratory diseases like Chronic Obstructive Pulmonary Disease, bronchiectasis was excluded from the study.

Data collection: Of the 175 patients examined, 100 of them fulfilled the required criteria and were thus included. A questionnaire was then used to assess the signs and symptoms of asthma. The socio economic status was recorded using the modified Kuppuswamy scale. For all the patients, periodontal evaluation was then carried out, which included the assessment of Oral hygiene index– simplified[11], gingival index[12], Probing depth and clinical attachment level[13]. Further assessment of periodontal parameters, all the patients were then referred to the Department of Pulmonary Medicine, Kasturba Medical College Mangalore for the definitive diagnosis of asthma.

Figure 2. Spirometry the LFT.

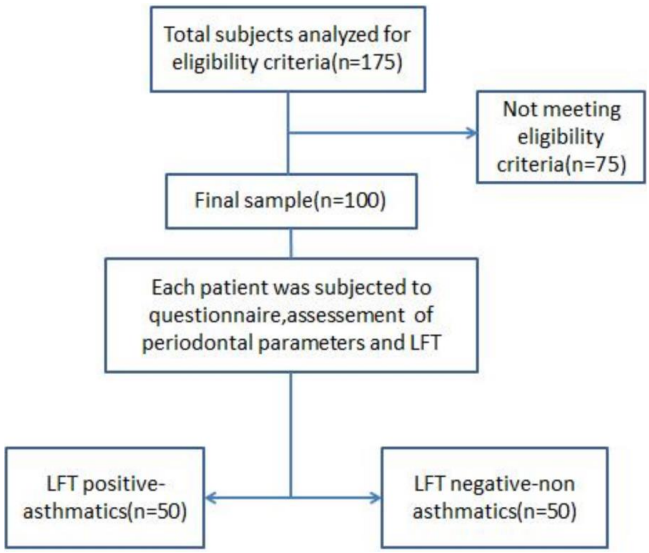

Figure 3a.

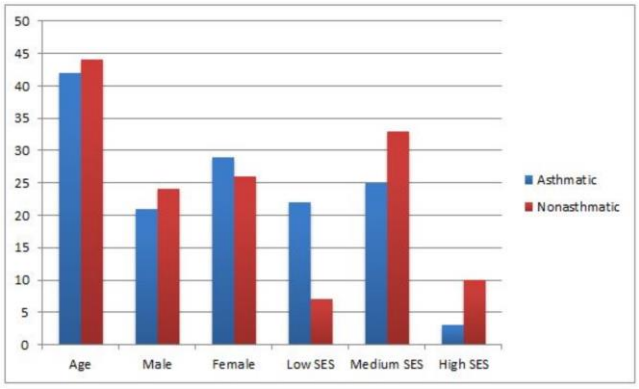

Figure 3b.

Figure 3a, b. Patients were made to sit and fitted with a mouthpiece, such that it is snuggly fit and the air that one breathes goes into the machine.

In the present study, Spirometry was the LFT(figure.2) that was carried out for assessment of asthma. This measures the amount of air one breathes in and out[14]. For this test (figure.3), patients were made to sit and fitted with a mouthpiece, such that it is snuggly fit and the air that one breathes goes into the machine. The patients were also made to wear a nose clip to keep from breathing air out through the nose. The respiratory technologist first explained the patients about the breathing method for the test. Spirometry measures the forced vital capacity (FVC, the maximum volume of air that can be exhaled) and the forced expiratory volume (FEV1), from which the FEV1/FVC ratio was calculated.Depending on the LFT values(FEV1%), the patients were divided into asthmatics(<70%) and nonasthmatics(>70%). Furthermore based on the FEV1 values the severity of asthma was categorized into mild, moderate, moderately severe, severe and very severe by American Thoracic Society (ATS) in 2005[15].

Statistical Analysis: Statistical analysis was carried out using Statistical software SPSS 20.0. Chi square test was used to compare age, medication, OHI-S, GI, mouthbreathing, GERD, rhinits within asthma group and within control group. Independent t test was used to compare age, medication, OHI-S, GI, mouthbreathing, GERD, rhinits between asthma and control group. Comparison of age, medication, OHI-S, GI, mouthbreathing, GERD, rhinits with the type of medication was done using one way annova and posthoc tukey test.

Results

In the present case control study prevalence of periodontal disease among 100 subjects was assessed and found to be 87%.Among the total sample(n=100) 50 were asthmatics and 50 were nonasthmatics, of which 96% of asthmatics had periodontal disease and 78% of nonasthmatics had periodontal diseases.

The prevalence of periodontal disease in the study sample was found to be 87%.Demographic data in asthmatic group and control group was shown in graph.1.Most of the study participants in the present study were in the age group of 40–50 years and mean age in asthmatics was (42.3±10.1 years) and in nonasthmatics (37.5±11.5 years). Majority of the patients were females (55) and males were 45.About 58% of sample belonged to middle SES (50% in asthmatics and 66% in nonasthmatics), 29% from low SES (44% in asthmatics and 14% in controls),only 13% from high SES. The difference was between the groups was found to be statistically significant (P value of 0.002).

		Group	
		Asthmatics	Non-asthmatics
OHI-S	Fair	47	17
	Good	3	33
GI	Mild	34	37
	Moderate	16	13
PD (Mean± Standard deviation)		4.608±0.95	3.874±0.94
CAL (Mean± Standard deviation)		4.19±.174	3.242±2.26
SEVERITY			
		Mild	Moderate	Severe
Periodontitis	Asthmatics	11(22%)	18(36%)	19(38%)
	Nonasthmatics	12(24%)	12(24%)	15(30%)
Asthma		24(48%)	20(40%)	6(12%)

Table 1. shows periodontal parameters and severity of periodontitis and asthma.

In periodontal parameters (table.1), Oral hygiene simplified index difference among the groups was statistically significant with a P value of 0.001. However the gingival index difference

between two groups was not statistically significant with a P value of 0.509. Mean probing depth in asthmatics was found to be 4.608±0.952 and in nonasthmatics it was 3.874±0.947, the difference between the two groups were found to be statistically significant with a p value of <0.001. Mean CAL in asthmatics was 4.19±2.074 and in nonasthmatics it was 3.242±2.265, the difference was found to be statistically significant with p value of 0.029. Severity of asthma and severity of periodontitis in asthmatics and nonasthmatics was shown in table.1

One way ANOVA test was carried out for comparison of Fev1, OHI-S,GI, PD and CAL in different type of medication (table.2).Results of this has shown that the mean value of fev1 was highest with no medication followed by inhalation, systemic least in combination, OHI-S mean value was highest in systemic followed by inhalation, combination least in no medication and mean value of GI score is highest in systemic followed by combination, no medication least in inhalation. However Mean probing depth was highest in combination followed by systemic, inhalation least in no medication and the mean CAL value of systemic was highest followed by combination, inhalation least in no medication. Posthoc tukey test(table.3) shows that the difference between no medication and inhalation, systemic, combination is statistically significant in terms of Fev1,OHI-S and mean probing depth. No statistical difference was found between asthmatics and nonasthmatics in comparision of risk factors (table.4).

Risk factors	Asthmatics(n)%	Nonasthmatics(n)%
Mouth breathing with periodontitis	10(5%)	5(2.5%)
Rhinitis with periodontitis	3(1.5%)	1(0.5%)
GERD with periodontitis	2(1%))	1(0.5%)

Table 4. Table showing comparison of risk factors with periodontitis among asthmatics and nonasthmatics.

Discussion

The prevalence of periodontal disease in the study sample was found to be 87%(96%in asthmatics and68% in nonasthmatics). This finding was in accordance with previous studies, wherein asthmatics were seen to have higher prevalence of getting periodontal disease .In contrast few studies has reported a negative association between the two diseases. Shulman et al 2003 found that there was no association between the periodontal parameters and asthma severity[16]. Freidrich et al 2006 reported an inverse association between periodontitis and asthma[17]. Rivera et al 2016 found that participants with severe periodontitis were less likely to have asthma[18]. Possible reasons could be due to reduced number of sample size, diagnosis of asthma being not standardized and data about asthmatic medication being unavailable. However in the present study standardization was taken care by using questionnaire for diagnosis of asthma and definitive diagnosis was done with spirometry. The questionnaire also included questions on medication and type of medication used for asthma.

Mean age in asthmatics was (42.3±10.1 years) and in nonasthmatics (37.5±11.5 years) in the present study and the difference was not statistically significant. Studies [18,19,20,21] reported that the asthmatics in this studies to be in the range of 37-52years. However most of the previous studies were done in children of 5-15years or <18 years to explore the prevalence of asthma[22,23,24]. Children/adolescents <18years were seen to have a higher prevalence of asthma as a high level of serum IgE has been observed in their cord blood and the presence of IgE predicts the subsequent development of asthma in childhood. Also an increase in the prevalence of respiratory syncytial virus (RSV) infections in this age group increases the risk of subsequent recurrent wheezing and asthma in early childhood[25].

In the present study; most of the patients who were diagnosed on having asthma were found to belong to the low SES and the same group was seen to have periodontal disease. The association between low SES with asthma and periodontal disease could be due to the lack of awareness and lack of oral hygiene practices. On other hand because of lack of awareness or concern regarding symptoms, differential access to health services and/or differential prescription and/or use of asthma medication in low SES people may also act as important factors which can affect both diseases[26].

In terms of OHI-S index 94% of patients with asthma had fair oral hygiene and 36% of them had good oral hygiene. This result may be because of the increased levels of calcium and phosphorus in submaxillary and parotid saliva of asthmatic patients[27].

However the simplified index takes only index teeth into consideration, which can either overestimatimate or underestimate the oral hygiene status. Whereas taking full mouth OHI scores becomes cumbersome, hence simplified index was preferred in present study.

Gingival status in the present study was measured using Silness and Loe index (GI).As it has the advantage of recording the gingival condition by noting the changes in the colour, consistency and bleeding as its components. However the difference in GI scores between two groups were not statistically significant with a P value of 0.509.Which was in contrast to other studies[29,30,31,32] .Although present study showed no statistical difference between the two groups in terms of GI, within asthmatics group significant difference was seen between types of medications and GI scores. The mean value of GI in patients on systemic therapy was found to be highest than others.

Mean probing depth in asthmatics was 4.608±0.952 and in nonasthmatics was 3.874±0.947 with statistical difference of P<0.001. Results were found to be similar to Gomez et al 2014 study. Probable reasons of increased PD may be due to improper oral hygiene, low SES and the effect of medications.

Periodontitis was measured using clinical attachment level, which was shown to be more in asthmatics (4.19±2.074) than nonasthmatics (3.242±2.265), similar results were shown by Ranjith et al 2015 [30] Gomez filho et al 2014[21] and Bharadwaj et al 2017[31].

Diagnosis of asthma was done using combination of questionnaire and LFT values in our present study, because LFT gives the accurate diagnosis of asthma by providing the exact variation in the values of oxygen consumption by the lung. However studies have used only questionnaires[34] or self- reported diagnosis of asthma[17,30] which could have been reason for misdiagnosis of asthma due to the improper history given by the patient or differences in conveying the problem, overestimation or underestimation of symptoms.

When the severity of asthma was correlated with severity of periodontitis there was no significant difference found between both the diseases. Periodontitis was however seen to be associated with the type of medication. Patients using inhalational medication had higher odds of getting mild periodontitis, patients under systemic medication therapy had higher odds of getting moderate periodontitis and severe periodontitis. Whereas patients using combination therapy had good periodontal status when compared to other medication. Reason of our study results may be because of number of asthmatics were more in mild and moderate category and less in severe category and the difference in the number of patients using different type of medications. Ranjith et al 2015 in their study, did not categorize periodontitis into mild and moderate to severe but reported that periodontal destruction increases with severity of asthma was found to be mean CAL 4.214 ± 1.016 in mild asthmatics and 6.156 ± 1.045 in moderate to severe asthmatics which was not statistically significant[30].

Common risk factors such as mouth breathing, GERD and allergic rhinitis for both periodontal disease and asthma were taken into consideration in the present study. Because the results from a systematic review by B D Havemann,et al 2007 indicate that the prevalence of symptoms of GERD is 1.6 times more among asthmatics when compared with nonasthmatics, its effect on the periodontal tissue may be due to alteration of salivary function, decreased salivary secretion which leads to insufficient acid neutralization in such patients[35]. The present study reported that mouth breathers had more gingival index score than who does not have mouth breathing habit, although no significant difference was found. Mouth breathing condition, commonly predispose the anterior area to develop periodontal disease, by decreasing salivary flow, since the continuous secretion of saliva provides a flushing action, which aids bacterial control[28]. Whereas there is limited evidence concerning the influence of mouth breathing on asthma morbidity or allergic/eosinophilic inflammation, the underlying mechanism of this relationship is said to because of the nasal–lower airway interaction. Our study results showed that patients with these risk factors in asthmatics had high prevalence of periodontal disease, although there was no significant difference in between two groups with

these risk factors. This might be due to fewer patients with these risk factors(15 patients had mouth breathing, 4 patients had allergic rhinitis and 3 patients had GERD), which were not enough to produce significant difference. Similar results were reported by Real et al 2016 where patients with GERD and allergic rhinitis had more gingival bleeding[34]. In terms of mouth breathing present study results was in accordance with Gomez et al 2014 wherein they observed 87.6% asthmatics had mouth breathing habit but they have not correlated it with periodontal disease[21]. Limitations: Sample size was small, dosages of medications were not recorded for asthmatics and duration of asthma was not considered as a separate parameter.

Conclusions

In conclusion, our study results found that it's not the severity of asthma but the type of medication which influences the severity of periodontitis.

Though, the present study has restrengthened the casual relationship between asthma and periodontal disease as shown by previous studies, a direct causal relationship between the two is yet to be established.

Further studies has to be carried out to prove the relationship by taking larger sample size and interventional studies with follow up to explore the effect of periodontal treatment in asthmatic patients.

Declaration of Interest

The authors report no conflict of interest.

		N	Mean	Std. Deviation	Statistics/ mean squares	df2(welch) / F(Anova)	p value
age	no medication	50	37.64	11.568	282.572	2.095	0.106
	inhalation	29	38.21	12.128			
	systemic	14	42.71	12.137			
	combination	7	47.86	7.734			
fev1	no medication	50	109.66	14.91	119.149	22.792	**<0.001**
	inhalation	29	72.55	5.173			
	systemic	14	65.43	5.302			
	combination	7	44.43	10.69			
Mean probing depth	no medication	50	3.874	0.947135	4.816	5.29	**0.002**
	inhalation	29	4.5	0.978337			
	systemic	14	4.692857	0.989533			
	combination	7	4.885714	0.807111			
OHI	no medication	50	0.608	0.390625	15.429	21.336	**<0.001**
	inhalation	29	1.017241	0.240638			
	systemic	14	1.271429	0.36675			
	combination	7	0.9	0.472582			
Gingival index	no medication	50	0.77	0.3887	0.539	3.597	**0.016**
	inhalation	29	0.686	0.4042			
	systemic	14	1.093	0.397			
	combination	7	0.786	0.241			
mean CAL	no medication	50	3.242	2.265544	1.948	29.531	0.143
	inhalation	29	4.113793	2.108101			
	systemic	14	4.314286	2.263373			
	combination	7	4.257143	0.884792			

Table 2. Comparison of the type of medication and various parameters using one way Anova.

Dependent Variable	COMPARISON GROUP	COMPARED WITH	MEAN DIFFERENCE	Std. Error	P VALUE
age	no medication	Inhalation	-0.567	2.711	0.997
		Systemic	-5.074	3.512	0.475
		Combination	-10.217	4.687	0.136
	inhalation	Systemic	-4.507	3.78	0.633
		Combination	-9.65	4.891	0.205
	systemic	Combination	-5.143	5.376	0.774
fev1	no medication	Inhalation	37.108*	2.684	**<0.001**
		Systemic	44.231*	3.477	**<0.001**
		Combination	65.231*	4.64	**<0.001**
	inhalation	Systemic	7.123	3.742	0.233
		Combination	28.123*	4.842	**<0.001**
	systemic	Combination	21.000*	5.323	**0.001**
Mean probing depth	no medication	Inhalation	-.6260000*	0.222708	**0.03**
		Systemic	-.8188571*	0.2885	**0.028**
		Combination	-1.0117143*	0.385043	**0.048**
	inhalation	Systemic	-0.1928571	0.310511	0.925
		Combination	-0.3857143	0.401799	0.772
	systemic	Combination	-0.1928571	0.441674	0.972
OHI	no medication	Inhalation	-.4092414*	0.083165	**<0.001**
		Systemic	-.6634286*	0.107733	**<0.001**
		Combination	-0.292	0.143784	0.184
	inhalation	Systemic	-0.2541872	0.115952	0.133
		Combination	0.1172414	0.150042	0.863
	systemic	Combination	0.3714286	0.164932	0.117
Gingival index	no medication	Inhalation	0.0838	0.0903	0.79
		Systemic	-.3229*	0.117	**0.034**
		Combination	-0.0157	0.1562	1
	inhalation	Systemic	-.4067*	0.1259	**0.009**
		Combination	-0.0995	0.163	0.928
	systemic	Combination	0.3071	0.1791	0.322
mean CAL	no medication	Inhalation	-0.8717931	0.503802	0.314
		Systemic	-1.0722857	0.652636	0.36
		Combination	-1.0151429	0.871031	0.65
	inhalation	Systemic	-0.2004926	0.702427	0.992
		Combination	-0.1433498	0.908936	0.999
	systemic	Combination	0.0571429	0.999141	1

Table 3. Comparison of the type of medication and various parameters using Posthoc tukey test.

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