

Role of Obstructive Sleep Apnoea in the Progression of Chronic Periodontitis - A Case Control Study

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Abstract

Aim: Periodontitis is a highly prevalent disease worldwide. Obstructive sleep apnoea (OSA) is a commonly occurring disorder that is characterized by repeated disruptions in breathing during the sleep, and mouth breathing is a frequent trait found among the patients with OSA. A connection between periodontitis and obstructive sleep apnoea (OSA) is plausible, but it has received a minuscule consideration. We intended to analyse the hypothesis that OSA is associated with the onset and progression of periodontal disease. This study is meant to research the strength of association between periodontitis and risk for OSA.

Method: Patients with moderate or severe periodontitis were enrolled as cases in this study while subjects with gingivitis or slight periodontitis were enrolled as controls. Patients underwent a full mouth periodontal examination that included probing pocket depths and clinical attachment levels evaluation at 6 sites per tooth. Risk for OSA was evaluated by the OSA screening questionnaire, which assesses self-reported snoring, excessive daytime sleepiness, and witnessed apnoea during sleep and history of hypertension and diabetes. Demographic, general health and orofacial characteristics were recorded that are considered putative predictors of either periodontitis or OSA.

Results: The results showed that out of total 150 patients examined, 34.7% subjects of control group (n=75), 21.6% males and 47.4% females were at a higher risk of OSA, with higher prevalence in females with $p=0.019$ (statistically not significant). Among the case group (n=75), 88.1% males and 90.0% females with chronic periodontitis showed an increased risk of OSA, with equal prevalence between males and females ($p=0.695$). Cases were more likely to be at high risk for OSA than controls.

Conclusion: A considerable association was noticed between moderate or severe periodontitis and risk for OSA.

Keywords:- Obstructive Sleep Apnoea (OSA), Chronic Periodontitis, Sleep Disruption, Gingival Diseases, Periodontal Medicine.

I. INTRODUCTION

Periodontitis is a chronic inflammatory disease which is initiated by a synergistic and dysbiotic microbial community eliciting a gingival inflammatory response which leads to tissue breakdown.^[1] It's a multifactorial disease primarily caused by plaque microorganisms with substantially modifying effects from other local and systemic factors. Periodontal diseases are amongst the most common afflictions that are faced by the human beings, affecting more than 30% of the population.^[2]

Periodontitis has been related to various systemic diseases including cardiovascular diseases, diabetes mellitus, obesity, respiratory disease^[3], chronic diseases of kidney^[3], cognitive impairment^[3], cancer, rheumatoid arthritis, osteoporosis etc.^[3] The notion that oral diseases can have influence on a distant structures is, to a certain extent, a return to the focal infection theory (around 1990s).^[4] The foci of sepsis are accountable for the initiation and progression of various inflammatory diseases. The anatomical proximity of the microfloras to the bloodstream can aid bacteremia and spread of bacterial products, components, and immunocomplexes systemically.^[5]

Obstructive sleep apnea (OSA), is a sleep disorder which is characterised by intermittent complete and partial collapse of airway, resulting in frequent episodes of apnea and hypopnea.^[6] The cardiovascular system becomes exposed to cycles of hypoxia, exaggerated negative intrathoracic pressure, and arousals due to repetitive episodes of apnoe. Such noxious stimulus can, in turn can initiate various activities like, depression of myocardial contractility, activation of the sympathetic nervous system, raising of blood pressure, heart rate, and myocardial wall stress, depression of parasympathetic activity, provoking oxidative stress and systemic inflammation, activating platelets, and impairing vascular endothelial function.^[7] There are increasing evidences to support OSAS (Obstructive Sleep Apnea Syndrome) as an independent risk factor for various diseases including cardiovascular and cerebrovascular disorders, including hypertension, congestive heart failure, myocardial infarction, cardiac arrhythmias, and stroke.^[8]

In view of the fact that both OSA and periodontal disease are very common disorders, and are also connected with systemic inflammation, we questioned if they may be associated with each other. Such a relationship could implicate concurrent periodontitis as an important mediator of inflammation in OSA, or vice versa. Hence, the objective of this study was to scrutinize the possible alliance between OSA and periodontitis. Specifically, we hypothesised that the prevalence of periodontitis is more amongst patients with OSA than in the general population.

Study Design

A total of 150 patients were enrolled in this case control study, which were then divided into two groups:
Control group: 75 subjects having gingivitis or slight periodontitis.
Test group: 75 subjects having moderate or severe periodontitis

Study Sample

These subjects were selected randomly from a larger sample representative of people reporting in the outpatient department of Periodontics of Sri Guru Ram Das Institute of Dental Sciences and Research in Amritsar in the state of Punjab, India.

Inclusion criteria:

- Aged 18 years and above
- Patients with poor oral hygiene with both gingivitis and periodontitis

Exclusion criteria:

- Patients with edentulous ridge
- Patients having the healthy periodontium

After giving each patient a concise explanation of the objectives of the study in conjunction with educational materials on OSA, a written consent was taken.

Data Collection

Each patient was given then a socio-demographic / behavioural questionnaire to fill, and all the clinical parameters were taken by the single investigator. The questionnaires included questions about the socio-demographic and clinical traits related with the risk of OSA.

Socio-demographic/Behavioral Questionnaire

The questionnaire included data regarding the patient's age, gender, weight, height, education, socio-economic status, quality of sleep (snoring, observed apnoea, lethargy during the day and nasal-breathing difficulty and medical history which included the information regarding the existence of various systemic conditions including the high blood pressure and diabetes mellitus).

Clinical Characteristics Questionnaire

Various physical parameters of patient were recorded including blood pressure, body-mass index (BMI) (by measuring weight and height of the patient) and their neck circumference (using a disposable tape measure). Soft tissue examination was done, which included the evaluation of the occurrence of dry mouth^[9] (by examining the moistness of oral mucosa, and by investigating if the mouth mirror stick to the mucosa), the incidence of macroglossia or large tongue^[10] (by observing lateral and anterior borders of the tongue) and the Mallampati score and tonsils grade^[11] (performed by making the patient sit with head in a neutral position, the mouth open widely and the tongue protruding to its maximum). Hard tissue examination included the inspection regarding the attrition of teeth, presence of overjet (a calibrated dental probe was used for measuring) and the maxillary arch's morphology (which was checked by examining the shape of the hard palate).

After the hard and soft tissue examination, periodontal parameters were recorded, which included Ramjford Periodontal Disease Index which had the following components:

Plaque Component

Gingival Component

Gingival And Periodontal Component

Measurement of the periodontal pocket depth and gingival recession was done using a calibrated probe .

The patients were classified into four groups:

Group I: Gingivitis

Group II: Slight (early) periodontitis

Group III: Moderate periodontitis

Group IV: Advanced (severe) periodontitis

These categories were classified on the basis of severity of attachment loss.

Data Collection and Analysis

Considering the responses given by the subjects in the questionnaire the risk of OSA was judged using the OSA screening tool known as STOP questionnaire. The four questions of it assess the incidence of symptoms like snoring, frequent daytime lethargy, observed difficulty in breathing or apnoea during sleeping and high blood pressure. Each question was responded with either “Yes” or “No.” Affirmative responses to any two or more of these four questions in the questionnaire’s scoring algorithm depicts high risk for OSA, while positive answers to fewer than 2 questions is suggestive of low risk for OSA.(Table 1, Figure 1)

Descriptive statistics were then used to sum and analyse the number of patients responding affirmatively to none, 1, 2, 3 or 4 of the STOP OSA screening items. The proportion of patients at greater risk for OSA were eventually calculated. The statistical significance was measured with help of pearson chi-square test, to study the alliance between the socio-demographic, behavioural and clinical features of the study population and their risk of OSA (Table 2)

II. DISCUSSION

This study explored the correlation between obstructive sleep apnoea and chronic periodontitis. Periodontitis’s prevalence was found to be greater in patients suffering from OSA than non- OSA patients. The study further extends the finding of Ahmad NE et al (2013) which observed that there is a noteworthy relationship between the moderate or severe periodontitis and risk for developing OSA [12]. The present study showed that among the case group 88.1% males and 90.0% females with chronic periodontitis showed an increased risk of OSA ($p=0.695$). Cases were found to be at high risk for developing OSA than controls. Different confounding variables were taken for this study and were statistically analysed as below:

Gender:- No significant gender predilection has been found between males and females with severe periodontitis for the risk of developing OSA (p value 0.695). An equal prevalence for the risk of OSA is observed which is in accordance with Ahmad NE et al(2013)[12] who also suggested the equal frequency for gender. However, in contrary to our results, Keller JJ et al (2013) [13] in his population based study found the males to be at greater risk of developing OSA as compared to females.

BMI: - The present study shows that obese people have higher risk of OSA than non obese people, which is similar to the results given by the studies of Vecchia CFD et al

(2005)[14], Chaffee BW et al(2010)[15] and Mathur LK et al(2011)[16]. Studies by Zahrani Al (2003)[17] also show that obesity is linked with greater prevalence of periodontitis and underweight individuals are associated with decreased prevalence. However, studies by Ahmad NE et al (2013)[12] do not show any significant association between obese individuals and increasing risk of OSA.

Nasal Breathing Difficulty: The study shows a significant association between nasal breathing and the risk for OSA. Young et al (1997)[18] in their epidemiological studies concluded that nasal congestion or difficulty in breathing from nose at night whether due to allergic rhinitis or due to upper respiratory tract infection, may be linked to snoring and OSA. Wagaiyu EG et al (1991)[19] assessed mouth breathing and their relationship with gingival inflammation and they concluded that mouth breathing or a high lip line increases susceptibility to gingival inflammation (gingivitis).

Blood Pressure: The present study shows a significant association between subjects being treated for high BP as compared to normotensive patients. The observations of the present study are in agreement with studies of Keller JJ et al (2013)[13], Young T et al (1997)[17], Nieto FJ et al (2000)[20], which stated that patients with hypertension are at greater risk of OSA.

III. CONCLUSION

Within the limitations of the present study, a significantly high association between moderate or severe periodontitis and risk for obstructive sleep apnoea can be concluded. This case control study suggests that obstructive sleep apnea (OSA) may be a risk factor for periodontal disease and vice-versa. Further cross sectional studies are also required to be conducted to substantiate the prevalence results and to elucidate the nature of relationship between periodontitis and OSA.

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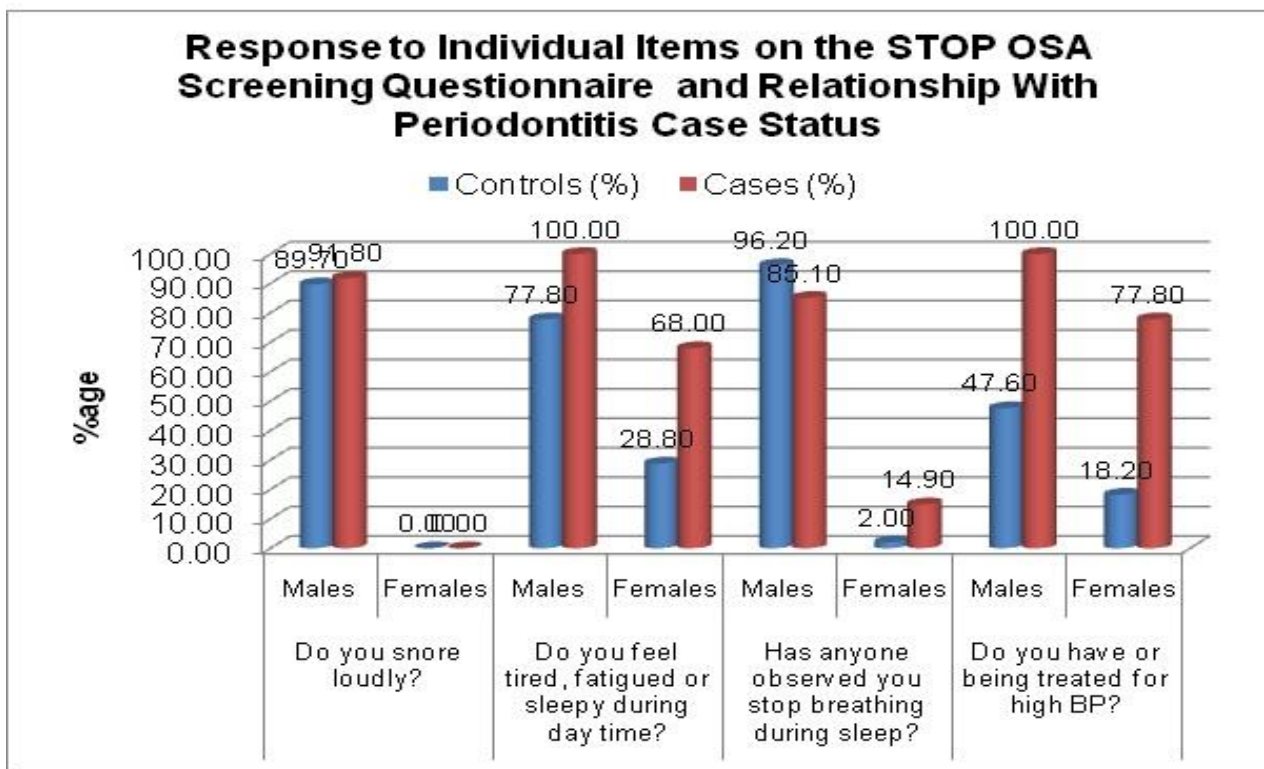
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	STOP Screening Questionnaire Items	Response	Controls (%) N=75	Cases (%) N=75	P-value
S	Do you snore loudly?	Males	89.7	91.8	0.000
		Females	-	-	
T	Do you feel tired, fatigued or sleepy during day time?	Males	77.8	100	0.004
		Females	28.8	68	
O	Has anyone observed you stop breathing during sleep?	Males	96.2	85.1	0.000
		Females	2	14.9	
P	Do you have or being treated for high BP?	Males	47.6	100	0.002
		Females	18.2	77.8	

Table: 1Response to Individual Items on the STOP OSA Screening Questionnaire and Relationship With Periodontitis Case Status

Characteristic	N(%) 75	% with high risk OSA	p-value
Gender			0.695
• Male	42(56)	55.2	
• Female	33(44)	44.8	
BMI			0.859
• Overweight	26(34.7)	34.3	
• Obese	49(65.3)	65.7	
Nasal Breathing difficulty			0.003
• Yes	57(76)	85.1	
• No	18(24)	14.1	
Dry Mouth			0.033
• Yes	39(52)	47.8	
• No	36(48)	52.2	

Table:2Relationship of study participant characteristics and high risk for obstructive sleep apnoea



GRAPH: 1Response to Individual Items on the STOP OSA Screening Questionnaire and Relationship With Periodontitis Case Status

Table Legends

1. Response to Individual Items on the STOP OSA Screening Questionnaire and Relationship With Periodontitis Case Status
2. Relationship of study participant characteristics and high risk for obstructive sleep apnoea

Figure Legends

1. Response to Individual Items on the STOP OSA Screening Questionnaire and Relationship With Periodontitis Case Status