

Interconnect Between Periodontal Disease & Daytime Somnolence: A Cross-Sectional Study

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Abstract

Background: Periodontal Diseases encompass diseases of the gingiva & supporting structures such as bone and cementum. Periodontal diseases are known to have an interconnect with cardiovascular diseases, metabolic disorders, and atherosclerosis. Recent evidence suggests a relationship between periodontal diseases and Obstructive sleep apneas (OSA).

Aim: The present study was conducted to assess the relationship between periodontal diseases and Daytime Somnolence using the Epworth Sleepiness Scale (ESS).

Results: The results of this study revealed a strong relationship between severity of periodontal diseases and Daytime somnolence, although not statistically significant.

Keywords: Obstructive sleep apnea (OSA), Daytime somnolence, Periodontitis, Gingivitis, Epworth Sleepiness Scale (ESS).

Introduction

Periodontal diseases are highly prevalent worldwide. It is a chronic infectious and inflammatory disease of gums (Gingivitis) and supporting tissues of the teeth (Periodontitis)¹. Recently, periodontitis has received increasing attention because it may have systemic effects, including diabetes, cardiovascular diseases, Obesity, Kidney disorders^{2,3,4}.

Common terminology given to pathology or abnormalities in aberrant respiratory pattern such as apneas, hypopneas, etc. is Sleep Related Breathing Disorders (SRBDs)^{5,6}.

Obstructive Sleep Apnea (OSA) is the commonest type of SRBDs, characterized by the collapse of the pharynx resulting in cessation or impairment of

breathing such as apneas and hypopneas. This causes inadequate stage of REM and oxygen desaturation in blood⁷. OSA is associated with significant morbidity, including excessive daytime sleepiness, loud snoring during sleep and impaired quality of life^{2,3,4}. It is estimated that nearly 80% of men and 93% of women with moderate to severe sleep apnea are undiagnosed⁸.

Undiagnosed OSA may pose a variety of problems for the anesthesiologist. In the laboratory, Polysomnography (PSG) is the accepted gold standard for diagnosing OSA⁹. However, it is a time-consuming and costly procedure. To deal with this issue, a number of screening questionnaires and clinical screening models have been developed to help identify patients with daytime somnolence (excessive sleep). Daytime somnolence is one of the key sign and symptoms of OSAs.

The relationship between periodontitis and OSA had not been investigated until the study by Gunaratnam et al¹⁰. These authors summarized that both periodontitis and OSAs are associated with systemic inflammation and cardiovascular disease, and found that the prevalence of periodontitis in patients with OSA was fourfold higher than the Australian national average. The mechanism of association between OSA and systemic inflammation is unclear. However, since both Periodontal diseases and OSA have high levels of inflammatory markers, there could be an independent interconnect between the two disease entities¹⁰.

Keeping this tenet as the background, this study was undertaken to investigate the plausible association between daytime somnolence which is a key predictor for OSA, using ESS and finding its correlation with chronic periodontitis.

Materials and Methods

Patient Selection and Study Design

A randomized controlled clinical study was conducted on patients reporting in the Department of Periodontics, at I.T.S Dental College, Hospital & Research Centre, Greater Noida. Ethical clearance was obtained from Ethical Committee at I.T.S Dental College, Hospital & Research Centre, Greater Noida. Patient consent was taken as per Helsinki guidelines.

Sample Size

The Sample size consisted of 200 subjects out of which 119 were males and 79 females, diagnosed with gingivitis or Chronic Periodontitis according to the criteria given in 1999 American Academy of Periodontology (AAP) Workshop¹¹. Patients were selected according to the following criteria.

Inclusion Criteria

1. No periodontal treatment within the previous 12 months.
2. No use of antibiotics within the previous 6 months.
3. Patients thus selected having a minimum of 14 teeth with at least 2 teeth per quadrant.

Exclusion Criteria

1. Patients with deleterious habits like smoking, alcohol consumption, tobacco chewing, beetle nut chewing.
2. Patients with known systemic disease and conditions known to predispose periodontal disease.
3. Pregnant and lactating mothers.
4. Patients using antibiotics within the previous 6 months.

All participants were asked to complete a self-administered questionnaire which consisted of age, gender, and personal history, previous medical and dental history.

Diagnosis of Periodontitis

Participants underwent a complete clinical periodontal examination. All periodontal data was collected and recorded on a periodontal chart. Periodontal assessments included

1. Pocket Probing Depth (PPD)
2. Clinical Attachment Level (CAL)
3. Gingival Index (GI)

Pocket Probing Depth (PPD) was defined as the distance between gingival margin and periodontal probe tip which was taken to be at the apical extent of the gingival sulcus¹².

Clinical Attachment Level (CAL) was defined as the distance between the cemento-enamel junction and bottom of the gingival sulcus¹². Patients were divided into 3 categories: Gingivitis, Localized Periodontitis, and Generalized Periodontitis.

Data Collection

All patients were given a questionnaire which was filled at the time of Periodontal examination. Questionnaire consisted of evaluation of:

1. Maxillary arch
2. Patient's Erosion Wear Examination
3. Patient's Overjet
4. Examination of Tongue size
5. Patient's Tonsil grade

Epworth sleepiness scale (ESS)¹³ was used as a tool to assess excessive daytime sleepiness/Somnolence.

The ESS is widely used in the field of sleep medicine as a subjective measure of a patient’s sleepiness. The test is a list of eight situations in which you rate your tendency to become sleepy on a scale of 0, no chance of dozing, to 3, high chance of dozing. When you finish the test, add up the values of your responses. Your total score is based on a scale of 0 to 24. The scale estimates whether you are experiencing excessive sleepiness that possibly requires medical attention.

1. chance of dozing =0
2. Slight chance of dozing =1
3. Moderate chance of dozing =2
4. High chance of dozing =3

Write down the number corresponding to your choice in the right-hand column. Total your score below.

Situation	Chance of Dozing
Sitting and reading	•
Watching TV	•
Sitting inactive in a public place (e.g., a theater or a meeting)	•
As a passenger in a car for an hour without a break	•
Lying down to rest in the afternoon when circumstances permit	•
Sitting and talking to someone	•
Sitting quietly after a lunch without alcohol	•
In a car, while stopped for a few minutes in traffic	•
Total Score =	_____

Interpretation

0-7: It is unlikely that you are abnormally sleepy.

8-9: You have an average amount of daytime sleepiness.

10-15: You may be excessively sleepy depending on the situation. You may want to consider seeking medical attention.

16-24: You are excessively sleepy and should consider seeking medical attention

Results

In this study out of Count of females and males doesn’t total up to 200 subjects. (119 males + 79 females = 198 subjects). Please advise if the counts have to be updated. Same appears in number of places across the paper.

All participants underwent a complete clinical periodontal examination. Periodontal assessment included Pocket Probing depth, Clinical attachment levels, Gingival index, and plaque index. Subjects were classified as having Gingivitis, Localized Periodontitis, and Generalized Chronic Periodontitis as per AAP Classification. (Table 1)

Reveals that out of 200 subjects, 30 had gingivitis, 86 were diagnosed as Chronic Localized Periodontitis and 64 had Chronic Generalized Periodontitis when defined as per the AAP Classification. (Table 2)

Mean Plaque index scores for 30 patients afflicted with Gingivitis was 1.6 (+_ 0.45), with Mean Gingival index scores being 1.5 (+_ 0.04). The ESS score was found to be 5.3 (+_ 1.6) in patients with Gingivitis. (Table 3).

Results of this study revealed that as the mean CAL & PPD scores increased the ESS scores also increased. It was found to be 7.6 (+_1.97)for localized Periodontitis patients and 7.25(+_1.30)for Generalized Chronic Periodontitis subjects. (Table 4 & 5).

Table 1: Distribution of Subjects as Per the Gender

Males (%)	Females (%)	Total No. of Subjects N (%)
119 (59.5)	79 (39.4)	200 (100)

Table 2: Distribution of Subjects as per periodontal disease status

Disease status	No. of Subjects n1	Percentage (%)
Gingivitis	30	15
Localized Periodontitis	86	43
Generalized Periodontitis	64	32
Total	200	100

Table - 3

Anova: Single Factor						
GINGIVITIS						
Groups	Count	Sum	Average	Variance		
ESSS	30	212	5.366667	1.688506		
MP	30	48	1.6	0.455172		
MGI	30	47.3	1.576667	0.040471		
MPD	30	120	4	0.282759		
MCAL	30	90	3	0.421379		
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	682.7984	4	170.6996	295.5031	0.05	2.434065
Within Groups	83.76033	145	0.577657			
Total	766.5587	149				

Table - 4

Anova: Single Factor						
LOCALISED PERIODONTICS						
Groups	Count	Sum	Average	Variance		
ESSS	86	657	7.639535	1.974419		
MP	86	143	1.662791	0.461423		
MGI	86	147.7	1.717442	0.316751		
MPD	86	403.5	4.69186	0.583109		
MCAL	86	306.6	3.565116	0.524886		
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	2105.453	4	526.3632	681.7137	0.03	2.39293
Within Groups	328.15	425	0.772118			
Total	2433.603	429				

Table - 5

Anova: Single Factor						
GENERALISED PERIODONTICS						
Groups	Count	Sum	Average	Variance		
ESSS	64	464	7.25	1.301587		
MP	64	107	1.671875	0.382688		
MGI	64	107.7	1.682813	0.046525		
MPD	64	440	6.875	0.590794		
MCAL	64	330.5	5.164063	0.509958		
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1892.788	4	473.1969	835.5786	0.02	2.400311
Within Groups	178.3878	315	0.566311			
Total	2071.176	319				

Discussion

This cross-sectional study was conducted with the aim of finding a co-relationship between the increase in the severity of periodontal disease and daytime somnolence, which is one of the key predictors (OSA) of and also to assess the risk of sleep apnea. Total subjects included in this study were 200 out of which 119 were males and 79 were females. The subjects were classified as per the periodontal status into Gingivitis, Localized Periodontitis, and Chronic Periodontitis as per the AAP Classification of periodontal Diseases¹¹.

Only subjects afflicted with the periodontal disease and unhealthy subjects were included due to the reasoning that OSA Patients have high levels of pro-inflammatory mediators and also higher levels of C-reactive proteins, similar to periodontal diseases^{14,15,16}. This study was designed to explore an association between plausible Obstructive sleep apnea (OSA) via checking daytime sleepiness and prior Periodontal disease. Recent studies have shown that the odds ratio for chronic periodontitis (cases) was 1.75 times greater than that of controls

In the present study patients diagnosed with gingivitis were considered as controls to patients afflicted with periodontitis as cases. All the subjects included in the study received full-mouth periodontal examination that

included assessment of PPDs and CALs at 6 sites per tooth. Subjects were also screened for full mouth Gingival & Plaque scores.

Obstructive sleep apnea (OSA) is characterized by recurrent complete or partial collapse of the pharynx resulting in impairment and/or cessation of breathing known as apnea and hypopneas⁷. The commonest symptoms of OSA are excessive daytime sleepiness and loud snoring^{2,3,4}. Therefore in the present study risk for OSA was assessed by measuring daytime sleepiness employing the Epworth Sleepiness Scale given by John MW¹³. This index is a widely used tool for a subjective measure of patients daytime sleepiness. Studies have revealed that a practicing dentist with a fair knowledge of sleep related breathing disorders (SRBDs) are just as likely to identify a patient at risk of Sleep disorders as a physician, by careful dentofacial examination and using indices like ESS & STOP-Bang questionnaires¹⁷. Keeping this tenet in mind, this study was conducted using ESS as a key to determine the need for a patient to seek medical attention.

Although the study did not reveal an urgent need for subjects of both Gingivitis (controls) & Periodontitis (cases) to seek immediate medical attention for SRBDs but the scores were relatively higher for Chronic Periodontitis patients than in subjects suffering from

gingivitis.(p-value). A similar study was conducted by Silva et al¹⁸ where ESS has been used to detect patients with potential sleep disordered breathing. Although Polysomnography (PSG) is the gold standard for diagnosing SRBDs⁹. However, before making a patient undergo a sleep study procedure, a chair side examination by a trained dentist could indicate the need for it.

An interrelationship between Periodontitis and other systemic diseases such Cardiovascular diseases and diabetes has been established by various authors^{2,3,4}. Recent evidence points a relationship between Chronic Periodontitis and OSA^{10,18}, although this relationship is still not well established.

The results of this study also revealed higher ESS scores for patients afflicted with both localized and Generalized Periodontitis than in subjects with gingivitis. The finding of our study is similar to a study done by Gunaratnam et al¹⁰ where they found the prevalence of periodontitis to be 77% in patients with confirmed OSA, which was four times the estimates of the Australian national average.

Higher scores of ESS in Periodontitis could be attributed to Hypoxia and oxidative stress caused due impaired breathing patterns in patients with OSA. Intermittent hypoxia in Sleep apnea patients could potentially trigger the release of reactive oxygen species (ROS) that can contribute to inflammation and endothelial destruction. Sleep apnea patients are known to have elevated levels of C-reactive proteins, cytokines, and inflammatory mediators just as seen in Chronic Periodontitis patients¹⁰. Since Periodontitis is also an inflammatory disease (Listgarten et al., 1986), there could be a plausible connect with SRBDs. This interrelationship has to be further substantiated and strengthened with longitudinal studies, confirmatory diagnosis of sleep apnea and removing confounding factors.

The results of the present study proposed that ESS scores interpretation in gingivitis subjects were within the range of 0 to 7 (5.6) that it is unlikely that the subjects are abnormally sleepy and no medical intervention is required.

The ESS scores for Localized & Generalized Periodontitis were similar but higher than gingivitis patients.

Our study triggers an idea that a dentist by chair side examination of Orofacial tissues, using standard

indices such as ESS scores and STOP-Bang questionnaires can pre-diagnose a patient as a risk for SRBDs and refer the patient to a sleep study specialist. Thereby early diagnosis of unknown subclinical cases of sleep apnea could reduce morbidity and mortality as SRBDs are known to cause cardiovascular diseases, Diabetes mellitus, and other systemic conditions.

The present study has limitations as there was no confirmatory diagnosis of sleep apnea by Polysomnography (PSG) and other objective tools such as Electroencephalogram (EEG). The diagnosis of the subjects in the present study was more subjective as ESS questionnaire was used as an assessing tool.

Conclusion

Albeit the subjective nature of ESS questionnaire employed to delineate the levels of daytime sleepiness in this study has attempted to establish a plausible link between two seemingly unrelated disease conditions that is Chronic Periodontitis and Obstructive sleep apnea; however both have a common inflammatory background.

Thus it becomes a prerogative as a dentist to identify SRBDs, evaluate and screen them on a dental chair and treat them with oral appliances such as mandibular advancement appliances (MAD) or refer such patients to a sleep therapist.

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