

## “Periodontitis and Sleep Deprivation”: Exploring, Assessing and Analyzing\_A Clinico Biochemical Study.

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### **Abstract.**

Sleep is important to health and wellbeing of an individual. Lack of sleep impacts human physical health by affecting the immune inflammatory mechanism. The changes are significant to initiate and contribute to destructive periodontal disease. The progression of the periodontal disease can be enhanced with changes in systemic parameters seen in systemic disease or factors such as sleep deprivation, stress etc.. The present study is designed to assess sleep duration, periodontal disease and biochemical changes.

### **MATERIALS AND METHODS.**

A total of 75 subjects were selected and categorized into three groups. 1.clinically healthy 2.Gingivitis 3. Chronic periodontitis. The periodontal status of the subjects of all the 3 groups was assessed by gingival index(Loe and Silness,1964) and pocket probing depth using UNC15 probe. Pittsburg sleep quality index(PSQI) questionnaire was used for the assessment of sleep duration. For all the three categories each subject was biochemically tested for the serum cortisol level. The PSQI score in relation to the various groups and cortisol level were statistically analysed.

### **RESULT.**

The results obtained in this study concluded that mean PSQI SCORE and the mean serum cortisol level was highest in the periodontitis group followed by gingivitis and healthy group and it was found to be statistically significant.

### **CONCLUSION.**

Sleep deprivation, stress and periodontal disease have a significant association. The outcome of the present study should be researched further with various other biochemical parameters and in depth analysis of sleep pattern and duration in a large group of subjects..

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## I. Introduction

Periodontitis is a multi-factorial chronic immune-inflammatory disorder affecting the investing and supporting tissues of the teeth which ultimately results in the resorption of the alveolar bone eventually resulting in tooth loss if left unattended. The evolution of the fact that periodontal disease is multi-factorial and can be associated with numerous systemic disorders such as diabetes, I Rheumatoid arthritis, chronic bronchitis, cardio and cerebrovascular disease and even some malignancies has resulted in the increased awareness and concern about preventing the disease at an early stage and resulted in advancement and emergence of various treatment modalities to control the disease.(1). The proposed mechanism of periodontitis as the effect of systemic disorders and risk for development of systemic disorders due to the periodontal disease can be due to three interactions 1. Metastatic infection, 2.inflammation and inflammatory injury 3.adaptive immunity.(2). Since periodontal disease is an immune-inflammatory disorder the endotoxin i.e (LPS) produced by plaque bacteria mainly gram -ve anaerobes when enters periodontal tissue and elicits a host response that results in the provocation of inflammatory reactions and events. In individuals with susceptible host the immune and inflammatory reaction get dysregulated which results in the progression of chronic inflammation and increased destruction of periodontal tissues.(3). Various studies have shown that there are numerous risk factors that make individuals susceptible to the periodontal disease and can alter the severity of the disease progression. These risk factors include diabetes, smoking, immunosuppression, genetic disorders, stress and age. Numerous studies have shown that inflammatory reaction as a connecting link between the risk factors and the disease progression. The factors that can modulate this inflammatory response can inadvertently lead to destruction of periodontal tissue.(4)

Sleep in general means a state of relaxation, but it is far beyond the normal light term, it is an unique and important physiological process that is required in regular basis for all the humans irrespective of their age,sex and ethnic origin. Numerous studies has proved this fact that sleep deprivation has serious and deleterious complication that affects overall human physiology of all the organ systems. The deprivation of sleep has its consequences on the immune system by decreasing its efficiency(5) altering the inflammatory pathways and increasing or decreasing the profile of inflammatory markers(6)(7) and it also alters that hormonal profile by upregulating it(8). Changes in the sleep culture has been noted mainly attributing to lifestyle changes and medical conditions. It has been proved by gathering the data from the epidemiological studies that alteration in sleep pattern and deprivation from the sleep adversely impact human physical health and also increases the risk of mortality(9,10,11,12,13,14,15,16,17). Since sleep deprivation can alter the hormonal and inflammatory pathways and their profile it can be a risk factor for the occurrence of various chronic inflammatory disorder. Since periodontal disease is an immuno inflammatory disorder it can also be a consequence of inadequate sleep? Hence the aim of this study was to evaluate any association between sleep deprivation and periodontal disease.

## **II. Materials And Methods.**

In this study ,75 subjects were included and divided into 3 groups (n=25) as clinically healthy, gingivitis and periodontitis from the patients visiting department of periodontology and implantology , Jaipur dental college Jaipur. All the subjects underwent detailed medical examination before enrolment into the study and the patient consent was signed by all the subjects involved in the study..

### **EXCLUSION CRITERIA.**

- 1.pregnant or lactating mother.
- 2.edentulous patients.
- 3.smokers
4. patients with systemic disorders ,patients underwent periodontal treatment within 6 months before the study and patients under medications (antibiotics and anti inflammatory) for past 3 months...

### **INCLUSION CRITERIA.**

Patient without any systemic disorder.  
subjects selected based upon the criteria were included in the study and screened for periodontal clinical parameters by gingival index(loe and sillness 1964) and pocket probing depth using UNC15 probe.  
All the subjects in each group were assessed for the sleep duration by using pittsburg sleep quality index(PSQI) and all the individuals were biochemically tested for serum cortisol level.

### **SUBJECT CATEGORIZATION.**

1. GROUP 1 - NO CAL, GI SCORE -0, PPD $\leq$ 3mm.
2. GROUP 2 - NO CAL,GI SCORE  $\geq$  1mm, PPD  $\leq$  3MM.
3. GROUP 3 - CAL  $\geq$  3mm,PPD $\geq$ 5mm

## **III. Statistical Analysis.**

statistical analyses were done with Statistical Package for Social Sciences version 15.0 (SPSS Inc., Chicago, IL, USA) software package..One way ANOVA test was used for comparison between means of groups and to determine the significance of each parameter of the study. Multivariate Tukey honest significant difference test was used to evaluate the relationship between Mean PSQI scores and Mean serum cortisol level . Pearson's correlation coefficient was used to correlate between various parameters

## **IV. Results**

In this study a total of 75 subjects were selected and categorized into 3 groups

1.Healthy 2.gingivitis 3. chronic periodontitis. All these subjects were subjected for evaluation of relation between lack of sleep and periodontal disease. In this study the mean serum cortisol level in group 1, group 2 & group 3 was 14.0736, 16.6224, 16.6224 respectively [table 1].Mean PSQI score in three groups were 2.8000, 4.6800, 6.4000 respectively.[table 2].

Intergroup comparison of mean serum cortisol & mean PSQI showed statistically significant difference at  $p < 0.05$ [table 3&4]. Multiple comparison of both mean serum cortisol & mean PSQI score using post hoc test showed statistically significant difference[table 5].

**TABLE 1**

1. Mean Serum Cortisol of the three groups analyzed using oneway ANOVA.

Serum_cortisol	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Healthy	25	14.0736	1.64914	.32983	13.3929	14.7543	11.62	16.83
Gingivitis	25	16.6224	1.51762	.30352	15.9960	17.2488	13.62	18.92
Periodontitis	25	21.7512	3.56429	.71286	20.2799	23.2225	14.82	26.76
Total	75	17.4824	4.01012	.46305	16.5598	18.4050	11.62	26.76

**TABLE 2**

Mean PQSI scores of the three groups analyzed using oneway ANOVA.

PQSI	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Healthy	25	2.8000	.91287	.18257	2.4232	3.1768	1.00	4.00
Gingivitis	25	4.6800	1.24900	.24980	4.1644	5.1956	2.00	7.00
Periodontitis	25	6.4000	2.10159	.42032	5.5325	7.2675	4.00	11.00
Total	75	4.6267	2.09745	.24219	4.1441	5.1092	1.00	11.00

PQSI- Pittsburg Sleep Quality Index

**TABLE 3**

Comparison of mean serum cortisol among all the three groups using one way ANOVA

Serum_cortisol	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	764.554	2	382.277	64.694	0.000
Within Groups	425.447	72	5.909		
Total	1190.002	74			

P<0.05 is considered significant

**TABLE 4.**

Comparison of mean PSQI score among all the three groups using one way ANOVA

PQSI	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	162.107	2	81.053	35.706	0.000
Within Groups	163.440	72	2.270		
Total	325.547	74			

P<0.05 is considered significant.

**TABLE 5**

Comparison of mean serum cortisol and mean PSQI score between all the three groups using Post hoc test (tukey HSD)

Dependent Variable	(I) grp	(J) grp	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Serum_cortisol	Healthy	Gingivitis	-2.54880 <sup>a</sup>	0.68755	0.001	-4.1942	-.9034
		Periodontitis	-7.67760 <sup>a</sup>	0.68755	0.000	-9.3230	-6.0322
	Gingivitis	Healthy	2.54880 <sup>a</sup>	0.68755	0.001	.9034	4.1942
		Periodontitis	-5.12880 <sup>a</sup>	0.68755	0.000	-6.7742	-3.4834
	Periodontitis	Healthy	7.67760 <sup>a</sup>	0.68755	0.000	6.0322	9.3230
		Gingivitis	5.12880 <sup>a</sup>	0.68755	0.000	3.4834	6.7742
PQSI	Healthy	Gingivitis	-1.88000 <sup>a</sup>	0.42615	0.000	-2.8998	-.8602
		Periodontitis	-3.60000 <sup>a</sup>	0.42615	0.000	-4.6198	-2.5802

Gingivitis	Healthy	1.88000*	0.42615	0.000	.8602	2.8998
	Periodontitis	-1.72000*	0.42615	0.000	-2.7398	-7.002
Periodontitis	Healthy	3.60000*	0.42615	0.000	2.5802	4.6198
	Gingivitis	1.72000*	0.42615	0.000	.7002	2.7398

\*. The mean difference is significant at  $P < 0.05$  level.

### V. Discussion

This study was designed to assess the association between the sleep deprivation and chronic periodontitis. As it has been proved by various studies that sleep deprivation can alter the hormonal profile and as well as the level of various inflammatory markers which is an initiating factor for various chronic inflammatory disorders, deprivation from sleep can also be a risk factor for development or progression of chronic periodontitis. So in this study we assessed the periodontal clinical parameters such as gingival index (Ioe and Sillness, 1963) and pocket probing depth using UNC15 Probe. The sleep quality was assessed with Pittsburgh sleep quality index and the mean serum cortisol level was assessed (Immulite 2000 cortisol detection kit).

The results obtained in this study showed that when mean PSQI score was compared between all three groups, it was found to be highest in the periodontitis group followed by gingivitis group and healthy group and the difference among the three groups was found to be statistically significant.

Even though there are various methods for evaluation of sleep quality in this study we have used PITTSBURGH SLEEP QUALITY index to assess the sleep quality. PSQI index is a questionnaire type index which is self-rated and used to evaluate the quality of the sleep and sleep disturbance pattern over a time period of one month.

Various studies done by Chung Feng Lee et al 2014, Anne E Sanders et al 2015, Viaksha Grover et al 2015<sup>[18,19]</sup> have assessed a positive association between sleep deprivation and chronic periodontitis. Sleep deprivation can alter the hormonal profile and can change the immune and inflammatory mechanism by increasing the lymphocyte activation and increase the production of IL-1, IL-6, TNF- $\alpha$  resulting in increased periodontal destruction.<sup>20</sup>

When mean serum cortisol level was compared between all the three groups it was found to be highest in the periodontitis group and the difference among the three groups was found to be statistically significant at  $p < 0.05$ .

Various studies done by Williams et al 1990 & Yarwood et al 1990<sup>21</sup> suggests that stress and other psychological factors bring about changes in immune function resulting in changes in immune suppression and enhancing the progression of periodontal disease.

Activation of HPA axis promotes the release of corticotrophin releasing hormone and glucocorticoids, resulting in the immune suppression and production of cytokines leading to increased susceptibility for periodontal infections.

When there is a disturbance in sleep HPA axis activates it suppresses the anti-viral (suppression of interferon  $\gamma$  and IL-12 B) and pro-inflammatory genes (suppression of IL-4 & IL-5), resulting in various infectious and inflammatory disorders<sup>1</sup>.

When correlation was done between mean PSQI & mean serum cortisol in each group it was found that correlation was significant only in the healthy group at  $p < 0.01$ .

### VI. Conclusion

Thus sleep deprivation, stress and periodontal disease have a significant association. The outcome of the study should be researched further with focused investigation using various biochemical parameters and in-depth analysis of sleep pattern and duration in a larger group of subjects.

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