

To compare and evaluate the association between anxiety and sleep quality in Periodontally healthy, gingivitis and periodontitis patients : a cross-sectional study

Subuhi Aqueel¹, Anita Mathur², Ishatm Dwivedi³,

Rama Dental College, Hospital & Research Centre, Rama University, Mandhana, Kanpur, U.P, India
- 209217, Email address: subuhisiddiqui24@gmail.com

Abstract

Aim: To assess the prevalence of sleep disturbances and anxiety and to evaluate their association with periodontal health among hospital patients in Kanpur, comparing periodontally healthy, gingivitis, and periodontitis patients.

Materials and Methods: A cross-sectional study was conducted among 200 hospital patients. Data were collected using a pre-validated questionnaire and clinical examination (CPITN index), covering demographics, oral health habits, sleep quality, and anxiety levels assessed with the Generalized Anxiety Disorder 7-item scale (GAD-7). Sleep disturbances and anxiety were analyzed in relation to periodontal status.

Statistical Analysis: Chi-square test performed using SPSS version 25.0.

Results: Among 200 patients, poor sleep quality was significantly associated with a 66% prevalence of periodontitis, compared to 46% in those with good sleep quality. Furthermore, moderate to severe sleep disturbances and elevated anxiety (20% severe anxiety in periodontitis versus 5% in gingivitis) strongly correlated with worsening periodontal disease. The findings demonstrate a clear association between worsening sleep quality, higher anxiety, and progression from healthy gingiva to gingivitis and periodontitis.

Conclusion: Sleep disturbances and anxiety are strongly linked to periodontal disease severity. Evaluating and managing these factors may improve both oral and overall health, particularly in hospital patients at risk for anxiety and sleep disorders.

Introduction

Sleep is a fundamental biological process essential for maintaining physical and mental health. However, patients visiting hospitals in Kanpur often experience disturbances in their sleep patterns due to factors such as stress, long working hours, and anxiety. These disruptions may exacerbate pre-existing systemic illnesses and raise the risk of chronic diseases including diabetes and cardiovascular problems by upsetting circadian rhythms and negatively impacting immunological and metabolic processes. Inadequate sleep and increased anxiety levels are also associated with hormonal dysregulation, inflammatory responses, and impairment of physiological processes including learning, memory consolidation, cellular repair, brain development, and neurobehavioral performance. Sleep deprivation has become increasingly common in modern society and has been linked to reduced immunity, systemic inflammation, and hormonal imbalances characterized by increased cortisol and ghrelin levels, impaired glucose metabolism, and elevated inflammatory markers. Anxiety further contributes to these physiological changes by activating the sympathetic nervous system and triggering stress responses that negatively affect overall health. Together, poor sleep quality and anxiety may increase susceptibility to depression and enhance the production of pro-inflammatory mediators.

A prevalent chronic inflammatory ailment that affects the teeth's supporting tissues is called periodontal disease, including the gingiva, periodontal ligament, and alveolar bone, and may ultimately lead to tooth loss. Previous studies have suggested an association between sleep quality and periodontal disease. Insufficient sleep may disturb immune balance and activate pro-inflammatory pathways, resulting in increased levels of biomarkers such as C-reactive protein, peripheral leukocytes, interleukin-6, and tumor necrosis factor-alpha (TNF- α), which may contribute to periodontal inflammation and disease progression. Anxiety has also been shown to influence immune responses and may further aggravate periodontal disease.

Elevated levels of interleukin-6 have been associated with poor sleep quality and may increase the risk of destructive periodontal diseases. Tumor necrosis factor-alpha (TNF- α), an important mediator in periodontal disease, promotes osteoclast formation leading to alveolar bone loss and regulates matrix metalloproteinases involved in connective tissue degradation. Despite these associations, limited studies have evaluated the

prevalence of gingivitis and periodontitis among hospital patients in relation to both sleep disturbances and anxiety.

Thus, the purpose of this research is to determine the frequency of sleep disturbances and anxiety among hospital patients in Kanpur and to investigate their association with periodontal health. This cross-sectional study aims to compare and evaluate the association between anxiety and sleep quality among periodontally healthy individuals, patients with gingivitis, and patients with periodontitis.

Materials and Methods

This cross-sectional study included 200 hospital patients in Kanpur. Informed consent was obtained after explaining the study, and incomplete questionnaires were excluded. Sleep quality was assessed using the Sleep Quality Scale (SQS), periodontal status with the CPITN, and anxiety using the GAD-7 scale. These tools were applied to compare and evaluate the association between anxiety and sleep quality among periodontally healthy individuals, patients with gingivitis, and patients with periodontitis.

Inclusion and Exclusion Criteria

Inclusion Criteria:

- Patients who were present at the hospital on the day of data collection and willing to participate.
- Patients diagnosed with **periodontally healthy, gingivitis, or periodontitis** conditions.
- Patients who were willing to participate and provide informed consent.

Exclusion Criteria:

- Patients who were not present during data collection.
- Patients who were unwilling to participate.
- Patients older than 60 years.
- Patients with a history of psychiatric disorders (other than anxiety) or those who were on medication for anxiety or depression.

Statistical Analysis:

Data were analyzed using **SPSS software version 25.0**. The association between anxiety levels, sleep quality, and periodontal health was assessed using the **Chi-square test**. The correlation between anxiety severity, sleep disturbances, and the presence of gingivitis or periodontitis was also analyzed.

Survey Instrument

Four sections of a pre-validated and tested questionnaire were used:

1. **Demographic Information:** This part asked about age, gender, marital status, and educational attainment.
2. **Self-Assessment of Harmful Habits:** This part included questions about alcohol use, smoking, betel nut use, and smokeless tobacco.
3. **Dental Health Assessment:** Oral health status was recorded using the **CPITN index** with a **CPITN-C probe** (0–healthy periodontium, 1–bleeding, 2–calculus, 3–shallow pocket, 4–deep pocket).
4. **Sleep Quality Scale (Hyeryeon Yi et al.):** This validated **28-item scale** assessed sleep quality using a four-point Likert scale, with responses categorized as rarely, sometimes, often, and almost always, scored as 0, 1, 2, and 3, respectively. Higher scores indicated more severe sleep disruptions. The total scores varied from 0 to 84.

28 Questions on the Sleep Quality Scale (SQS)

These inquiries are used to evaluate several facets of sleep quality, including sleep disruption, difficulty in falling asleep, daytime sleepiness, and satisfaction with sleep.

1. I have difficulty falling asleep.
2. I wake up during the night.
3. I wake up too early and cannot fall asleep again.
4. I feel tired when I wake up in the morning.
5. I feel sleepy during the daytime.
6. I feel that my sleep is insufficient.
7. I have trouble staying asleep throughout the night.
8. My sleep is restless.
9. I feel refreshed after waking up.
10. I have difficulty getting comfortable when trying to sleep.
11. I feel that I sleep too little.
12. I have trouble relaxing before sleep.
13. I worry about not getting enough sleep.
14. I feel anxious or tense when trying to sleep.
15. I wake up because of disturbing dreams.
16. I wake up because of noise or other disturbances.
17. I take a long time to fall asleep.
18. I feel my sleep is of poor quality.
19. I feel satisfied with my sleep.
20. I have difficulty concentrating during the day because of poor sleep.
21. I feel physically exhausted due to lack of sleep.
22. I feel mentally exhausted due to lack of sleep.
23. I wake up feeling unrested.
24. I feel that my sleep schedule is irregular.
25. I feel that my sleep problems affect my daily activities.
26. I feel irritable because of poor sleep.
27. I feel that my sleep is not deep enough.
28. Overall, I feel that I sleep well.

Each question is scored from 0 to 3:

- 0 – Rarely
- 1 – Sometimes
- 2 – Often
- 3 – Almost Always

Total score helps determine the level of sleep disturbance and overall sleep quality.

5- Generalized Anxiety Disorder 7-item Scale (GAD-7): This widely used screening tool assessed the severity of anxiety symptoms in participants. The **GAD-7** scale uses a four-point Likert scale (0–not at all, 1–several days, 2–more than half the days, 3–nearly every day) to evaluate the frequency of anxiety-related symptoms over the past two weeks. Total scores range from 0 to 21, with higher scores indicating greater severity of anxiety.

The questionnaire was administered to hospital patients in Kanpur. **GAD-7 (Generalized Anxiety Disorder-7) Scale – 7 Questions**

The GAD-7 is a screening tool used to measure the severity of anxiety. Patients are asked how often they have been bothered by the following problems during the last two weeks.

Questions

1. Feeling nervous, anxious, or on edge.
2. Not being able to stop or control worrying.
3. Worrying too much about different things.
4. Trouble relaxing.
5. Being so restless that it is hard to sit still.

6. Becoming easily annoyed or irritable.
7. Feeling afraid as if something awful might happen.

Table 1: Comparison between Sleep Quality, Anxiety, and Periodontal Status (n = 200)

Sleep Quality	Healthy Gingiva	Gingivitis	Periodontitis	Total	p-value
Good Sleep Quality	6 (6%)	48 (48%)	46 (46%)	100 (100%)	0.012*
Poor Sleep Quality	2 (2%)	32 (32%)	66 (66%)	100 (100%)	
Total	8 (4%)	80 (40%)	112 (56%)	200 (100%)	

Note: Statistically significant (Chi-square test)

Results

The study included a total of 200 hospital patients. Of these, 30% (n = 60) were female and 70% (n = 140) were male. The age distribution showed that 50% of participants were between 20 and 30 years, 45% were between 30 and 40 years, and 5% were above 40 years of age. In terms of education, 44% of participants had finished high school, 38% had graduated, 12% had just completed middle school, and 6% were illiterate.. In terms of marital status, 52% of the participants were married, while 48% were unmarried.

A significant association was observed between sleep quality and periodontal status. Patients with poor sleep quality demonstrated a higher prevalence of periodontitis compared to those with good sleep quality. Among patients reporting good sleep quality, 6% exhibited healthy gingiva, 48% had gingivitis, and 46% were diagnosed with periodontitis. In contrast, patients with poor sleep quality showed a markedly higher prevalence of periodontitis (66%), with only 2% presenting with healthy gingiva and 32% exhibiting gingivitis. This association was found to be statistically significant ($p < 0.05$), indicating a strong relationship between sleep disturbances and periodontal health (Table 1).

Sleep disturbances were further categorized based on severity. Mild sleep disturbances were observed in 39% of patients, while 54% experienced moderate disturbances and 7% reported severe sleep disturbances. Worsening sleep quality may have a negative impact on periodontal health outcomes, as patients with moderate to severe sleep disruptions had a considerably greater incidence of periodontitis than those with mild disturbances.

(Table 2).

A statistically significant association was observed between sleep disturbances and periodontal health. Among patients diagnosed with gingivitis (n = 80), 60% (n = 48) reported mild sleep disturbances, while 40% (n = 32) experienced moderate sleep disturbances. In contrast, patients with periodontitis (n = 112) demonstrated more severe sleep-related problems, with 27% (n = 30) reporting mild sleep disturbances, 68% (n = 76) experiencing moderate disturbances, and 5% (n = 6) reporting severe sleep disturbances. This strong association ($p < 0.001$) indicates that deteriorating sleep quality may play a critical role in the progression of periodontal disease (Table 3).

Anxiety and Sleep Quality:

The study also examined anxiety levels among participants, using the Generalized Anxiety Disorder 7-item scale (GAD-7) to assess anxiety severity. A significant correlation was found between higher anxiety levels and worse sleep quality. Patients with moderate to severe anxiety reported significantly higher sleep disturbances than those with mild or no anxiety ($p < 0.05$).

Table 4 shows the distribution of anxiety levels among patients according to their periodontal status. Among the healthy gingiva group (n = 2), 50% of patients had no anxiety and 50% had moderate anxiety, while none showed mild or severe anxiety.

In the gingivitis group (n = 80), most patients showed moderate anxiety (50%), followed by mild anxiety (30%). A smaller proportion had no anxiety (15%), and only 5% experienced severe anxiety.

Among patients with periodontitis (n = 112), moderate anxiety (45%) was again the most common. Severe anxiety was higher in this group (20%) compared to gingivitis patients. Additionally, 21% had mild anxiety and 14% had no anxiety.

Overall, out of 200 participants, 46% had moderate anxiety, 24% had mild anxiety, 15% had no anxiety, and 13% had severe anxiety. The findings suggest that higher levels of anxiety are more common in patients with more severe periodontal disease, particularly periodontitis.

Table 2: Distribution of Sleep Disturbance Severity Among Hospital Patients (n = 200)

SQS Scale	Number of Patients	Percentage
Mild Sleep Disturbance	78	39%
Moderate Sleep Disturbance	108	54%
Severe Sleep Disturbance	14	7%
Total	200	100%
SQS: Sleep Quality Scale		

Table 3: Comparison Between Periodontal Status and Sleep Pattern (n = 200)

Periodontal Status	Mild	Moderate	Severe	Total	p-value
Healthy Gingiva	2 (100%)	0	0	2 (100%)	<0.001*
Gingivitis	48 (60%)	32 (40%)	0	80 (100%)	
Periodontitis	30 (27%)	76 (68%)	6 (5%)	112 (100%)	
Total	80 (40%)	108 (54%)	6 (3%)	200 (100%)	
SOS: Sleep Quality Scale					

Note: *Statistically significant*

Table 4: Anxiety and Periodontal Status (n = 200)

Periodontal Status	No Anxiety	Mild Anxiety	Moderate Anxiety	Severe Anxiety	Total
Healthy Gingiva	1 (50%)	0	1 (50%)	0	2 (100%)
Gingivitis	12 (15%)	24 (30%)	40 (50%)	4 (5%)	80 (100%)
Periodontitis	16 (14%)	24 (21%)	50 (45%)	22 (20%)	112 (100%)
Total	29 (15%)	48 (24%)	91 (46%)	26 (13%)	200 (100%)

Discussion

The present cross-sectional study evaluated the association between sleep disturbances, anxiety, and periodontal health among 200 hospital patients in Kanpur. The study aimed to compare and evaluate the relationship between anxiety and sleep quality in periodontally healthy patients, those with gingivitis, and those with periodontitis. The findings provide insight into the prevalence of sleep-related problems, anxiety, and their relationship with gingival and periodontal status.

A higher prevalence of periodontitis was observed among patients with poorer sleep quality, along with lower proportions of healthy gingiva and gingivitis. A notable association was identified between increasing severity of sleep disturbances and worsening periodontal status. Patients experiencing moderate to severe sleep disturbances demonstrated a greater likelihood of periodontitis compared to those with mild disturbances.

Furthermore, patients with higher anxiety levels were more likely to report severe sleep disturbances and more advanced periodontal disease. This supports the concept that both sleep quality and anxiety may influence inflammatory responses and immune regulation, thereby affecting periodontal health. Similar associations have been reported in previous studies, suggesting that sleep disturbances and anxiety exert a broad and consistent impact on both oral and systemic health.

Patients with severe sleep disturbances and elevated anxiety were more likely to exhibit periodontitis rather than gingivitis or healthy gingiva, consistent with the systematic review by Muniz et al., which reported poorer sleep quality among individuals with periodontitis. The results highlight the multifactorial nature of periodontal disease and underscore the need for comprehensive patient evaluation. Addressing sleep quality and anxiety management may therefore be key to improving periodontal and overall health outcomes among hospital patients.

Anxiety levels varied, with patients experiencing more severe periodontal disease tending to have higher anxiety scores, emphasizing the importance of considering anxiety when evaluating the relationship between sleep disturbances and periodontal health.

Conclusion

The present study underscores the significant role of sleep disturbances and anxiety in influencing periodontal health among 200 hospital patients in Kanpur. Results indicate a strong correlation between poor sleep quality, heightened anxiety, and a higher prevalence of periodontitis, with patients experiencing more severe sleep disturbances and anxiety being at greater risk for advanced periodontal disease.

Anxiety management and strategies to improve sleep quality should be integrated into oral health care practices, particularly for hospital patients at higher risk for both.

The study emphasizes the importance of implementing targeted strategies to enhance both sleep quality and periodontal health, which may ultimately lead to improved oral and overall health outcomes.

References

1. Depner CM, Stothard ER, Wright KP Jr. Metabolic consequences of sleep and circadian disorders. *Curr Diab Rep* 2014;14(7):507. DOI: 10.1007/s11892-014-0507-z.
2. Grover V, Malhotra R, Kaur H. Exploring association between sleep deprivation and chronic periodontitis: A pilot study. *J Indian Soc Periodontol* 2015;19(3):304–307. DOI: 10.4103/0972-124X.154173.
3. Suresh S, Doraikannan S, Jayakumar ND, et al. Working hours impact on the sleep quality and oral health status among migrant construction workers in Chennai. *J Family Med Prim Care* 2022;11(7):3511–3516. DOI: 10.4103/jfmpc.jfmpc_2101_21.
4. Muniz FWMG, Pola NM, Silva CFE, et al. Are periodontal diseases associated with sleep duration or sleep quality? A systematic review. *Arch Oral Biol* 2021;129:105184. DOI: 10.1016/j.archoralbio.2021.105184.
5. Weiner RC. Relationship of routine inadequate sleep duration and periodontitis in a nationally representative sample. *Sleep Disorder* 2016;2016:9158195. DOI: 10.1155/2016/9158195.
6. Taştan Eroğlu Z, Özkan Şen D, Uçan Yarkac F, et al. The association between sleep quality, fatigue and periodontal status: A pilot study. *Odobtos* 2023;25(3):99–117. DOI: 10.15517/ijds.2023.54866.
7. Kinane DF, Stathopoulou PG, Papapanou PN. Periodontal diseases. *Nat Rev Dis Primers* 2017;3:17038. DOI: 10.1038/nrdp.2017.38.
8. Park JS, Jeong Y, Jung J, et al. Shift work sleep disorder is closely associated with an increased risk for periodontal disease. *J Clin Periodontol* 2021;48(8):1066–1075. DOI: 10.1111/jcpe.13508.
9. Jung SK, Lim HK, Jeong Y, et al. Influence of shift work on periodontitis according to the occupation group. *Sci Rep* 2023;13(1):17921. DOI: 10.1038/s41598-023-45222-z.
10. Sato Y, Yoshioka E, Saijo Y. Association of rotating night shift work with tooth loss and severe periodontitis among permanent employees in Japan: A cross-sectional study. *PeerJ* 2024;12:e17253. DOI: 10.7717/peerj.17253.
11. Camilo da Silva e Silva W, Costa NL, Rodrigues DS, et al. Sleep quality of adult tobacco users: A systematic review of literature and meta-analysis. *Sleep Epidemiol* 2022;2:100028. DOI: 10.1016/j.sleep.2022.100028.
12. Nagappan N. Tobacco use among migrant construction workers in Kancheepuram by using GATS India survey questionnaire. *Tob Induc Dis* 2021;19(Suppl 1):A287. DOI: 10.18332/tid/141619.
13. Singh VP, Gan JY, Liew WL, et al. Association between quality of sleep and chronic periodontitis: A case-control study in Malaysian population. *Dent Res J (Isfahan)* 2019;16(1):29–35. PMID: PMC6340225.
14. Setia S, Singh S, Mathur A, et al. Sleep quality impact on the oral health status of sugar mill workers of Fazilka, Punjab: A cross-sectional study. *J Indian Assoc Public Health Dent* 2019;17(2):125–129. DOI: 10.4103/jiaphd.jiaphd_109_18.