

# Association between Sleep Quality and Periodontal Status among Industrial Workers in Chennai: A Cross-sectional Study

Parvathy Premnath<sup>1</sup>, Susmitha Sunil Kumar<sup>2</sup>, Varsha Rajagopalan<sup>3</sup>, Sunil Jeyaseelan<sup>4</sup>, Sussvikha Suresh Kumar<sup>5</sup>

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## ABSTRACT

**Background:** Shift work, particularly rotating shifts, has been associated with health issues such as sleep disturbances and systemic diseases, potentially influencing periodontal health. This study explores the relationship between shift work, sleep disturbances, and periodontal conditions among industrial workers.

**Aim:** To assess the prevalence of sleep disturbances and their association with gingivitis and periodontitis in industrial workers in Chennai, focusing on the impact of shift work.

**Setting and design:** A cross-sectional study was conducted among 146 industrial workers. Participants were categorized based on their shift patterns—rotating shifts and fixed day shifts.

**Materials and methods:** Data were collected using a pre-validated questionnaire and clinical examination (CPITN index), covering demographics, habits, oral health, and sleep quality.

**Statistical analysis used:** Chi-square test using SPSS software version 25.0.

**Results:** Workers on rotating shifts exhibited significantly poorer periodontal health, with a higher prevalence of periodontitis and lower rates of gingivitis and healthy gingiva compared to fixed day shift workers. Severe sleep disturbances were more common in rotating shift workers, and individuals with severe sleep disturbances were more likely to have periodontitis. Smokers showed a higher prevalence of sleep disturbances and worse periodontal health outcomes.

**Conclusion:** The study highlights the negative impact of rotating shift work on both sleep quality and periodontal health. There is a strong association between sleep disturbances, smoking, and periodontitis, emphasizing the need for targeted interventions to improve health outcomes in industrial workers.

**Keywords:** Industrial workers, Oral health, Periodontal disease, Sleep quality.

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## INTRODUCTION

Shift work, which involves working hours outside the typical 9:00 AM to 5:00 PM schedule, often disrupts circadian rhythms. This circadian disruption, especially in night-shift workers, significantly increases the risk of chronic diseases such as diabetes and cardiovascular disease.<sup>1</sup> When sleep patterns are disrupted, the immune and metabolic systems are compromised, exacerbating pre-existing systemic conditions.<sup>2</sup> The long working hours, heavy workload, and insufficient sleep experienced by industrial workers, especially those on night shifts, contribute to poor oral and general health outcomes.<sup>3</sup> Therefore, sleep quality is recognized as a fundamental aspect of individual health.<sup>4</sup> While the term “sleep” is often associated with rest or relaxation, it is, in reality, a complex and essential biological process required daily by all humans, irrespective of age, sex, or ethnicity. In today’s fast-paced society, sleep deprivation is becoming increasingly common, and it has been shown to have adverse effects on physical health.<sup>5</sup> This is primarily due to a decrease in overall immunity, the onset of systemic inflammation marked by increased inflammatory markers, and hormonal imbalances that contribute to the deterioration of overall health.<sup>3</sup>

Inadequate sleep affects several vital functions, including learning, memory processing, cellular repair, brain development, and neurobehavioral performance. It is also linked to hormonal dysregulation, such as increased levels of cortisol and ghrelin, impaired glucose metabolism, and heightened inflammatory responses.

<sup>1-5</sup>Department of Public Health Dentistry, Asan Memorial Dental College and Hospital, Chengalpattu, Tamil Nadu, India

**Corresponding Author:** Parvathy Premnath, Department of Public Health Dentistry, Asan Memorial Dental College and Hospital, Chengalpattu, Tamil Nadu, India, Phone: +91 9566299609, e-mail: dr.parvathypachat@gmail.com

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These disruptions can increase the risk of depression and lead to elevated levels of pro-inflammatory markers.<sup>6</sup> Many studies have reported the correlation between sleep quality and periodontal diseases.<sup>7</sup>

Periodontal disease, a widespread chronic inflammatory condition, affects the supporting structures of teeth, including the gingiva, bone, and periodontal ligament, potentially resulting in tooth loss.<sup>8</sup> Conversely, a short sleep duration can influence the balance between the immune system and periodontal disease.<sup>9</sup> The activation of pro-inflammatory pathways by sleep deprivation has been found to elevate the levels of C-reactive protein, peripheral leukocytes, interleukin-6, and tumor necrosis factor-alpha (TNF- $\alpha$ ).

Increased levels of interleukin-6 have been linked to lower sleep quality, which, in turn, raises the risk of destructive periodontal diseases. TNF- $\alpha$ , a critical mediator in periodontal disease, stimulates the formation of osteoclasts, leading to alveolar bone loss, and regulates matrix metalloproteases that degrade connective tissue.<sup>4</sup>

Despite the growing recognition of these links, no study has specifically examined the distinct prevalence of gingivitis and periodontitis among industrial workers, particularly in the context of sleep disorders. The aim of this study is to assess the prevalence of sleep disturbance in industrial workers in Chennai and their association with gingivitis and periodontitis.

## MATERIALS AND METHODS

The present cross-sectional study was conducted among industrial workers in Chennai on September 18, 2024, with a sample size of 146 participants. The workers were selected through a convenience sampling method, including only those who were present on the day of data collection. The study was approved by the Institutional Review Board of Asan Memorial Dental College and Hospital, Chengalpattu. Informed consent was obtained from all participants before the start of the study, during which the purpose and theme of the study were clearly explained. Participants had the option to terminate or exit the survey at any time without providing a reason, and not completing the questionnaire was considered non-consent. The anonymity of participants was maintained, and no personal information was included in the survey.

Before the study commenced, 2 examiners were standardized and calibrated in the Department of Public Health Dentistry at Asan Memorial Dental College, Chennai, to ensure uniform interpretation, understanding, and application of scores used in the study. The examiners, referred to as Examiner A and Examiner B, were trained to record the sleep quality scale (SQS) and a pre-validated questionnaire and clinical examination (CPITN index).

### Inclusion and Exclusion Criteria

- Workers who were present on the day of data collection and willing to participate in the study were included.
- Workers who were not present during data collection, workers who were not willing to participate in the study, and those who were older than 60 years were excluded.

### Survey Tool

A pre-validated and tested questionnaire was used, containing four parts:

1. Demographic details: This part included age, gender, educational level, marital status, work schedule (fixed night, fixed day, rotating shift), and work experience.
2. Self-assessment of deleterious habits: This section contained questions regarding smoking, alcohol use, betel nut, smokeless tobacco, and working hours per week.
3. Oral health assessment: This section recorded the oral health status using the CPITN index with the CPITN-C probe (0-healthy periodontium, 1- bleeding, 2- calculus, 3-shallow pocket, 4-deep pocket).
4. Sleep quality scale (Hyeryeon Yi et al.): The final part included a validated 28-item scale assessing sleep quality. The sleep quality scale utilized a four-point Likert scale, with responses categorized as (rarely, sometimes, often, and almost always) and scored as 0, 1, 2, and 3, respectively. Total scores range from 0 to 84, with higher scores demoting more acute sleep problems.

**Table 1:** Comparison between work schedule and periodontal status

Work schedule	Periodontal status			Total	p-value
	Healthy gingiva	Gingivitis	Periodontitis		
Fixed day	1 (1%)	34 (60%)	22 (39%)	57 (100%)	0.020*
Rotating shift	0 (0%)	35 (39%)	54 (61%)	89 (100%)	
Total	1 (1%)	69 (47%)	76 (52%)	146 (100%)	

\*Statistically significant

## Statistical Analysis

Descriptive statistics were used to summarize the data, and the Chi-square test was employed to assess associations between categorical variables. All *p*-values were adjusted, with values < 0.05 considered statistically significant. The statistical analyses were conducted using the SPSS statistical software package (version 25.0).

## RESULTS

The study included 146 industrial workers, of whom 29% were female ( $n = 43$ ) and 71% were male ( $n = 103$ ). The age distribution of the participants showed that 52% were between 20 and 30 years old, 47% were between 30 and 40 years old, and only 1% fell within the 40–50 age range. In terms of educational background, 42% of participants had completed high school, 40% held undergraduate degrees, 12% had a middle school education, and 6% were illiterate. Regarding marital status, 50% of the participants were married, while 45% were unmarried. The analysis revealed significant correlations between smoking habits, sleep disruptions, work schedules, and periodontal health, highlighting the complex interplay between lifestyle factors and health outcomes in this population.

Among the 57 fixed day shift workers, only 1% ( $n = 1$ ) exhibited healthy gingiva, while the majority, 60% ( $n = 34$ ), were diagnosed with gingivitis, and 39% ( $n = 22$ ) suffered from periodontitis. In contrast, none of the 89 rotating shift workers presented with healthy gingiva. Instead, 39% ( $n = 35$ ) were diagnosed with gingivitis, and a significant 61% ( $n = 54$ ) were diagnosed with periodontitis. The statistically significant association ( $p = 0.020$ ) suggests a potential link between rotating shift work and the deterioration of periodontal health, warranting further investigation (Table 1).

Sleep disturbances also exhibited variation between the two groups. Among fixed day shift workers, 46% ( $n = 26$ ) reported mild sleep disturbances, 54% ( $n = 31$ ) experienced moderate disturbances, and none reported severe sleep issues. Meanwhile, rotating shift workers experienced higher rates of moderate and severe sleep disturbances, with 43% ( $n = 38$ ) reporting mild disturbances, 55% ( $n = 49$ ) experiencing moderate sleep disturbances, and 2% ( $n = 2$ ) reporting severe sleep disturbances. Although these differences were observed, the variation in sleep patterns between the two groups did not reach statistical significance ( $p = 0.509$ ), indicating that sleep disturbances may be influenced by additional factors (Table 2).

A significant association emerged between sleep disturbances and periodontal health. Of the 69 participants with gingivitis, 62% ( $n = 43$ ) experienced mild sleep disturbances, while 38% ( $n = 26$ ) reported moderate disturbances. In the group with periodontitis ( $n = 76$ ), 28% ( $n = 21$ ) experienced mild sleep disturbances, 70% ( $n = 53$ ) reported moderate disturbances, and 2% ( $n = 2$ ) suffered

from severe sleep disturbances. This strong association ( $p < 0.001$ ) suggests that sleep quality plays a critical role in the progression of periodontal disease (Table 3).

Smoking habits were found to significantly impact sleep patterns. Among non-smokers, 45% ( $n = 50$ ) experienced mild sleep disturbances, while 55% ( $n = 61$ ) reported moderate sleep disturbances. None reported severe disturbances. However, smokers experienced more pronounced issues, with 40% ( $n = 14$ ) experiencing mild disturbances, 54% ( $n = 19$ ) experiencing moderate sleep disturbances, and 6% ( $n = 2$ ) suffering from severe disturbances. This statistically significant finding ( $p = 0.039$ ) reinforces the negative impact of smoking on sleep quality (Table 4).

Despite this, no significant association between smoking habits and periodontal health was identified ( $p = 0.826$ ). Among non-smokers, 48% ( $n = 53$ ) had gingivitis and 52% ( $n = 57$ ) had periodontitis, while 46% ( $n = 16$ ) of smokers were diagnosed with gingivitis, and 54% ( $n = 19$ ) suffered from periodontitis (Table 5).

In conclusion, this study underscores the compelling connection between shift work, sleep disturbances, and periodontal health. Rotating shift workers exhibited significantly poorer gum health, with higher rates of periodontitis, coupled with more severe sleep disturbances. Smoking was also linked to greater sleep issues,

though its impact on periodontal status was not statistically significant. Given the established link between periodontal disease and systemic health, it becomes even more vital to address these factors in occupational health frameworks. Future research should further explore the psychosocial implications of shift work and its broader impact on periodontal health and general well-being, addressing potential interventions that target both sleep and oral health as part of a holistic approach to occupational health.

## DISCUSSION

In order to evaluate the connection between shift work and periodontal health, we examined cross-sectional data from 146 Chennai industrial workers. This study provided useful information about the frequency of sleep disturbances among Chennai's industrial workers and how they relate to periodontitis and gingivitis. Compared to people who work fixed-day shifts, those who work rotating shifts had a higher chance of developing periodontitis, as well as lower rates of gingivitis and healthy gums.<sup>10</sup> Notably, there was a considerable correlation between more severe periodontitis and sleep disruptions, especially among smokers. Our results support those from other countries, highlighting the widespread influence of shift work on health outcomes.

Our findings suggest that individuals working rotating shifts exhibit significantly poorer periodontal health compared to those working fixed day shifts. This observation aligns with the findings of Sato et al.,<sup>11</sup> who reported that rotating night shift work for 1–5 years was associated with an increased risk of severe periodontitis. These results suggest that shift patterns, particularly rotating shifts, may play a critical role in influencing periodontal health.

Sleep disturbances were commonly observed among individuals with periodontitis in our study, with those experiencing severe sleep disturbances being more prone to periodontitis than gingivitis or healthy gums. This is in line with the systematic review by Muniz et al.,<sup>5</sup> which highlighted that individuals with periodontitis tend to have poorer sleep quality compared to those without the condition. This indicates that addressing sleep disturbances could be vital in managing periodontal health.

We also found that smokers in our study experienced more sleep disturbances than non-smokers. This aligns with the systematic review and meta-analysis by Camilo et al.,<sup>12</sup> which demonstrated that cigarette consumption adversely affects sleep quality. This further suggests that smoking may indirectly worsen periodontal health by disrupting sleep patterns.

The proportion of current smokers in our study was 24%, which is consistent with the findings of Nagappan<sup>13</sup> where the prevalence of current smokers was less than 50%. However, this is in contrast to the study by Sushanthi Suresh et al.<sup>4</sup> where the prevalence of current smokers was reported to be 76.3%. From this, we can conclude that smoking prevalence among industrial workers varies across different studies, possibly due to demographic or regional factors.

**Table 2:** Comparison between work schedule and sleep pattern

Work schedule	SQS scale			Total	p-value
	Mild	Moderate	Severe		
Fixed day	26 (46%)	31 (54%)	0	57 (100%)	0.509
Rotating shift	38 (43%)	49 (55%)	2 (2%)	89 (100%)	
Total	64 (44%)	80 (55%)	2 (1%)	146 (100%)	

SQS, sleep quality scale

**Table 3:** Comparison between periodontal status and sleep pattern

Periodontal status	SQS scale			Total	p-value
	Mild	Moderate	Severe		
Healthy gingiva	0	1 (100%)	0	1 (100%)	<0.001*
Gingivitis	43 (62%)	26 (38%)	0	69 (100%)	
Periodontitis	21 (28%)	53 (70%)	2 (2%)	76 (100%)	
Total	64 (44%)	80 (55%)	2 (1%)	146 (100%)	

\*Statistically significant, SQS, sleep quality scale

**Table 4:** Comparison between smoking habit and sleep pattern

Habits	SQS scale			Total	p-value
	Mild	Moderate	Severe		
Non-smoking	50 (45%)	61 (55%)	0	111 (100%)	0.039*
Smoking	14 (40%)	19 (54%)	29 (6%)	35 (100%)	
Total	64 (44%)	80 (55%)	2 (1%)	146 (100%)	

\*Statistically significant, SQS, sleep quality scale

**Table 5:** Comparison of smoking habit and periodontal status

Habits	Periodontal status			Total	p-value
	Healthy gingiva	Gingivitis	Periodontitis		
Non-smoking	1 (1%)	53 (48%)	57 (51%)	111 (100%)	0.826
Smoking	0	16 (46%)	19 (54%)	35 (100%)	
Total	1 (1%)	69 (47%)	76 (52%)	146 (100%)	

Moreover, a previous study on the Malaysian population demonstrated a significant association between poor sleep quality and periodontitis, which mirrors the findings of our research.<sup>14</sup> This consistency across diverse populations suggests a broader connection between sleep quality and periodontal health that warrants further exploration.

A study by Salvi Setia et al. on sugar mill workers in Punjab showed that a significant proportion of shift workers experienced poor sleep quality, and similarly, our study found that severe sleep disturbances were more prevalent among rotating shift workers compared to those on fixed day shifts.<sup>15</sup>

Despite the contributions of this research, certain limitations should be acknowledged. First, the study relied on self-reported questionnaires, which introduces the potential for reporting bias. Additionally, we were unable to include workers on fixed night shifts, limiting the study's ability to comprehensively compare different shift types and restricting our focus to rotating and fixed day shifts. Moreover, prospective studies are needed to establish causality and better understand the underlying mechanisms. Another key limitation is that participants' oral hygiene practices, dietary habits, and underlying systemic diseases were not considered in the analysis. Given the multifactorial nature of periodontitis, these overlooked variables may have influenced the results, casting uncertainty on the study's overall conclusions.

## CONCLUSION

This study highlights the significant impact of shift work, particularly rotating shifts, on periodontal health and sleep disorders among industrial workers in Chennai. Our findings reveal a strong association between rotating shifts and increased prevalence of periodontitis, with individuals experiencing more severe sleep disturbances also being more prone to advanced periodontal disease. The link between smoking, sleep disturbances, and periodontal health further underscores the multifactorial nature of these conditions. While our research provides valuable insights, further studies are needed to explore additional factors such as oral hygiene habits, systemic health conditions, and the inclusion of fixed night shift workers. Overall, our study underscores the need for targeted interventions to improve both sleep quality and oral health in industrial shift workers.

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