Natural Resources for Human Health
eISSN: 2583-1194

Original Research

Received 18 July 2026
Revised 17 Aug 2026
Accepted 01 Sep 2026

Natural Resources for Human Health 2026, Vol. 6 (21s): 1289–1299

KEYWORDS:
Sleep, Periodontitis, Probing pocket depth, STOP-BANG Sleep Apnea questionnaire, Epworth Sleep Scale, Healthcare

"Possible association between Sleep and Periodontal Health" – A Cross-Sectional Study

Arvinda Siva J[1], Deepak Moses Ravindran[2], Divya Kumar[3], Dhanadivya[4], Lekha Ashokkumar[5], S.K. Balaji[6]

[1]Post graduate, Department of Periodontics, Sri Ramachandra Dental College and Hospital, Sri Ramachandra Institute of Higher Education and Research, India. Email id: arvindvijay0203@gmail.com ORCID ID: 0009-0000-3036-0910
[2] Associate Professor, Department of Periodontology, Sri Ramachandra Institute of Higher Education and Research, Porur, Chennai-600116.
Email ID: deepak_perio@sriramachandra.edu.in ORCID ID: 0000-0003-2814-3209
[3] Senior Lecturer, Department of Periodontology, Sri Ramachandra Institute of Higher Education and Research, Porur, Chennai-600116.Email ID: divyakumar@sriramachandra.edu.in ORCID ID: 0000000319503671
[4]Senior Lecturer, Department of Periodontics, Sri Ramachandra Dental College and Hospital, Sri Ramachandra Institute of Higher Education and Research, India. Email id: k.dhanadivya@sriramachandra.edu.in ORCID ID: 0000-0001-9931-5405
[5]Senior Lecturer, Department of Periodontology, Sri Ramachandra Institute of Higher Education and Research, Porur, Chennai-600116. Email ID- drlekha@sriramachandra.edu.in
[6] Professor, Department of Periodontology, Sri Ramachandra Institute of Higher Education and Research, Porur, Chennai-600116. Email Id: balajisk@sriramachandra.edu.in. ORCID ID: 0000-0002-2286-223X
Corresponding Author: Associate Professor, Department of Periodontology, Sri Ramachandra Institute of Higher Education and Research, Porur, Chennai-600116. Email ID- deepak_perio@sriramachandra.edu.in ORCID ID: 0000-0003-2814-3209

ABSTRACT: BACKGROUND:

Periodontitis is defined as an inflammatory disease of supporting tissues of teeth resulting in progressive destruction of the periodontal ligament and alveolar bone. Sleep deprivation is quite a common problem in today's world. Over the past few decades, there has been a significant change in the human sleep pattern due to extended work hours, longer shifts and extreme work pressure. This Cross-sectional study aims at clinically evaluating the probable association between patients with Obstructive Sleep Apnea and Periodontal disease.

METHODS:

A total of 39 participants visiting the OPD of the Department of Respiratory Medicine, Sri Ramachandra Dental College and Hospital were screened. Status of the periodontium was assessed and questionnaires were used for severity of sleep disorder assessment.

RESULTS:

The present study demonstrates a clear association between STOP-Bang risk groups and various clinical periodontal parameters. Individuals classified as intermediate and high risk according to the STOP-Bang questionnaire consistently show poor periodontal health compared to those in the low-risk group.

Natural Resources for Human Health
eISSN: 2583-1194

CONCLUSION:

In summary, this study emphasizes underscores the importance of considering sleep health as a potential risk factor in periodontal disease progression. Given the bidirectional relationship between sleep disturbances and periodontal conditions, integrating sleep disorder screening into regular practice could facilitate early identification of at-risk patients and enable more comprehensive management strategies.

1. INTRODUCTION

Periodontitis is defined as an inflammatory disease of supporting tissues of teeth caused by specific Microorganisms or groups of specific microorganisms, resulting in progressive destruction of the periodontal ligament and alveolar bone with periodontal pocket formation, gingival recession or both [1]. Various risk factors, including diabetes, smoking, genetic predisposition, immunosuppression, stress, and aging, contribute to the development, severity, and pathogenesis of these diseases [2]. Lack of sleep is linked with harmful effects on one's physical, mental, and dental health. Sleep deprivation is quite a common problem in today's world. Over the past few decades, there has been a significant change in the human sleep pattern due to extended work hours, longer shifts and extreme work pressure. Lifestyle changes have contributed adversely to more health issues and the demands of social and family life often limit the amount of time people can dedicate to rest. As a result, both adults and children are now getting considerably less sleep than they did in previous generations. Among the different types of sleep disorders (circadian rhythm disorders, sleep-wake disorders, central hypersomnolence disorders, and sleep-related movement disorders), osa, or obstructive sleep apnea, has the greatest disease morbidity if left untreated [3]. Over the past decade, research has increasingly highlighted a potential link between sleep disorders and periodontal conditions, suggesting important implications for clinical diagnosis and management [4]. This cross-sectional study aims at clinically evaluating the association between patients with obstructive sleep apnea and their periodontal health by assessing their clinical periodontal parameters.

1.1 Aim

Cross-sectional studies evaluating probing pocket depth, clinical attachment loss, plaque index, gingival index and questionnaires (Epworth sleepiness scale and stop-bang sleep apnea questionnaire) were not present in available literature. This study aims to fill this knowledge gap.

2. MATERIALS AND METHODS

2.1 Study Design and Setting

This Cross-sectional study was conducted between January 2025 to March 2025 in the Department of Respiratory Medicine, Sri Ramachandra Institute of Higher Education and Research.

2.2 Ethical Approval

The study protocol was approved by the Institutional Ethics committee of Sri Ramachandra Institute of Higher Education and Research, Porur, Chennai (IECNO: CSP-III/25/MAR/19/186)



FIG 1 Recruitment of patients from the Department of Respiratory Medicine

Natural Resources for Human Health
eISSN: 2583-1194

2.3 Subjects Selection

A total of 39 participants visiting the OPD of the Department of Respiratory Medicine, Sri Ramachandra Dental College and Hospital were screened for eligibility based on the below mentioned specific criteria after obtaining informed consent. Inclusion criteria for the study comprised

- Individuals aged more than 30 years with Obstructive Sleep Apnea categorized by specialist from the Department of Respiratory Medicine based on clinical examination and Epworth Sleepiness Scale (ESS), STOP-Bang questionnaire
- Minimum 20 teeth present
- Full mouth Bleeding on probing (BOP) present - recorded at six sites per tooth (mesio-, mid-, and disto-vestibular; mesio-, mid-, and disto-palatal) using a calibrated periodontal probe

Exclusion criteria included

- Individuals on Antibiotic / any other drugs for past 3 months
- Individuals with Type 2 Diabetes Mellitus
- Patients who received any periodontal treatment, including oral prophylaxis in the past 6 months.
- Pregnant or lactating females
- Individuals with unacceptable restorations or Bridges / Orthodontic Appliances

2.4 Clinical Examination

Baseline clinical examination was done in 40 participants which included the Silness and Loe Plaque Index (PI)[5], Gingival Index (GI)[6], probing pocket depth (PPD) and clinical attachment level (CAL), which was recorded at six sites per tooth (mesio-, mid-, and disto-vestibular; mesio-, mid-, and disto-palatal/lingual) Probing pocket depth (PPD), was measured from the base of the gingival crevice to the marginal gingival [7], Clinical attachment loss (CAL), it was identified as the distance from the cementoenamel junction (CEJ) to the bottom of the gingival sulcus [8], both PPD and CAL was measured using calibrated UNC 15 Periodontal probe.

2.5 Methodology for Clinical Examination

Indices and clinical parameters such as Plaque Index, Gingival Index, Probing Pocket Depth and Clinical Attachment Loss were assessed.

PLAQUE INDEX

The measurement of oral hygiene by Silness-Loe plaque index is based on recording both soft debris and mineralized deposits on the teeth.

GINGIVAL INDEX

The measurement of oral hygiene by Loe- Silness Gingival Index is based on recording the Changes in Colour and consistency of Gingiva

Gingival Index (GI) Range: 0 to 3

Interpretation: 0: Healthy gingiva 0.1-1: Mild inflammation 1.1-2: Moderate inflammation 2.1-3: Severe inflammation [6]

PROBING POCKET DEPTH (PPD) - The depth of the sulcus can be assessed by gently inserting a graduated UNC 15 periodontal probe until resistance is encountered at the base of the sulcus. The depth from the free gingival margin to the base of the sulcus is measured in millimeters at six sites around the tooth.

Probing Pocket Depth (PPD) Range: Measured in millimeters (mm)

Interpretation: Normal PPD is ≤3 mm in healthy sites ≤4 mm in treated stable periodontitis [9]

Natural Resources for Human Health
eISSN: 2583-1194

CLINICAL ATTACHMENT LOSS (CAL) -The Clinical attachment loss was assessed from the cemento-enamel junction to the base of the pocket.

Clinical Attachment Level (CAL) Range: Measured in millimeters (mm)

Interpretation: Mild: 1-2 mm Moderate: 3-4 mm Severe: 5 mm or more [9]

The assessment of Probing Pocket Depth and Clinical Attachment Loss was depicted in figure 2



FIG 2 Assessment of Probing Pocket Depth and Clinical Attachment Loss

The patients were also requested to answer the questionnaire-Epworth sleepiness scale and the risk of OSA was also evaluated using STOP-BANG Sleep Apnea Questionnaire.

2.6 Assessment of Epworth Sleepiness Scale

The Epworth Sleepiness Scale (ESS) was initially established by Murray Johns in 1990 and published in 1991 [10]. The ESS is a brief, user-friendly survey that evaluates subjective drowsiness in normal situations. Users assign a value between 4 and 24 on a 4-point rating system, which represents how much likely they are to fall asleep in eight distinct settings. Scores typically range from 0 to 10. If the score is greater than 10, further medical evaluation is required. A score ranging from 0 to 3 is assigned to each scenario: 0 = would not be able to sleep 1 is a low possibility of falling asleep. A score of 2 indicates a moderate chance of falling asleep. 3 means a greater possibility of sleeping

Epworth Sleepiness Scale[11]

How likely are you to nod off or fall asleep in the following situations, in contrast to feeling just tired? This refers to your usual way of life in recent times.

Even if you haven't done some of these things recently, try to work out how they would have affected you. It is important that you answer each question as best you can.

Use the following scale to choose the most appropriate number for each situation.

	Would never nod off 0	Slight chance of nodding off 1	Moderate chance of nodding off 2	High chance of nodding off 3
Sitting and reading				
Watching TV				
Sitting, inactive, in a public place (e.g., in a meeting, theater, or dinner event)				
As a passenger in a car for an hour or more without stopping for a break				
Lying down to rest when circumstances permit				
Sitting and talking to someone				
Sitting quietly after a meal without alcohol				
In a car, while stopped for a few minutes in traffic or at a light				

Add up your points to get your total score. A score of 10 or greater raises concern: you may need to get more sleep, improve your sleep practices, or seek medical attention to determine why you are sleepy.

Natural Resources for Human Health
eISSN: 2583-1194

2.7 Assessment of Stop-Bang Sleep Apnea Questionnaire

The general population has a high frequency of OSA, with a significant percentage of cases going untreated. To address the requirement for a dependable, succinct, and user-friendly screening tool, the STOP-Bang questionnaire—which stands for snoring, fatigue, observed apnea, high blood pressure, BMI, age, neck circumference, and male gender—was created. Eight dichotomous (yes/no) questions about the clinical characteristics of sleep apnea make up this test. The overall score falls between 0 and 8. Based on their individual scores, patients can be categorized for OSA risk. [11]

A person with obstructive sleep apnea (OSA) often stops breathing while they are asleep. It arises from a blockage of the upper airway caused by insufficient tongue and/or airway dilator muscle muscular tone. About 33.5% of obese individuals are at high risk for OSA, which affects 2–4% of the adult population. In India, the prevalence of OSA ranges from 6.2% to 13.7%. Through the activation of transcription factors and enhanced cytokine production, it has been hypothesized that intermittent hypoxia in OSA may contribute to the systemic inflammatory response [12].

The initial purpose of the STOP-Bang questionnaire was to evaluate the OSA in surgical patients. Apnea hypopnea index (AHI) >5, moderate-to-severe OSA (AHI >15), and severe OSA (AHI >30) could all be predicted with a sensitivity of 83.9%, 92.9%, and 100%, respectively, using the STOP-Bang score ≥3 as the cut-off. To identify patients at high risk of OSA, the STOP-Bang questionnaire has been used extensively in preoperative clinics, sleep clinics, the general public, and other special populations because of its high sensitivity and ease of use [13].

Name _____
Height _____ Weight _____
Age _____ Male / Female _____

STOP-BANG Sleep Apnea Questionnaire

Chung F et al Anesthesiology 2008 and BJA 2012

STOP		
Do you SNORE loudly (louder than talking or loud enough to be heard through closed doors)?	Yes	No
Do you often feel TIRED, fatigued, or sleepy during daytime?	Yes	No
Has anyone OBSERVED you stop breathing during your sleep?	Yes	No
Do you have or are you being treated for high blood PRESSURE?	Yes	No

BANG		
BMI more than 35kg/m2?	Yes	No
AGE over 50 years old?	Yes	No
NECK circumference > 16 inches (40cm)?	Yes	No
GENDER: Male?	Yes	No

TOTAL SCORE		

High risk of OSA: Yes 5 - 8

Intermediate risk of OSA: Yes 3 - 4

Low risk of OSA: Yes 0 - 2

2.8 Outcomes Assessed

The outcomes assessed in this study were Indices and clinical parameters such as Plaque Index, Gingival Index, Probing Pocket Depth, Clinical Attachment Level. Questionnaires such as Epworth sleepiness scale and STOP-BANG sleep apnea questionnaire were also assessed.

2.9 Statistical Analysis

IBM SPSS version 23 was utilized for the analysis of both descriptive and inferential data. We summarized quantitative data using mean and SD. Quantitative data were summarized using percentage and frequency. A one-way ANOVA was used to compare the groups, and the categorical variables were compared using the chi square test. P values <0.05 were regarded as statistically significant differences throughout the course of the study.

Natural Resources for Human Health
eISSN: 2583-1194

3. RESULTS

Table 1: The association between STOP-Bang risk groups and various clinical periodontal parameters

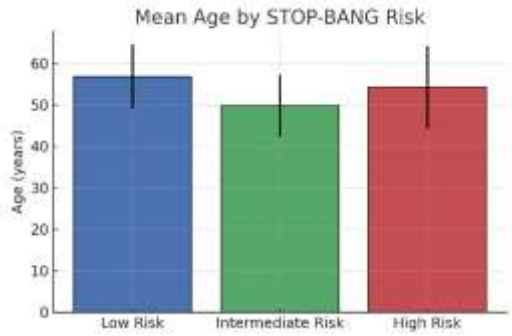
Parameter	STOP Bang	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		P value
						Lower Bound	Upper Bound	
Age	Low risk	8	56.88	7.717	2.728	50.42	63.33	0.218
	Intermediate risk	11	49.82	7.427	2.239	44.83	54.81	
	High risk	20	54.30	9.985	2.233	49.63	58.97	
	Total	39	53.56	9.055	1.450	50.63	56.50	
PPD mm	Low risk	8	1.525000	.8154753	.2883141	.843246	2.206754	<0.001
	Intermediate risk	11	3.224545	.5120813	.1543983	2.880525	3.568566	
	High risk	20	3.244000	.8323170	.1861117	2.854464	3.633536	
	Total	39	2.885897	1.0141388	.1623922	2.557152	3.214643	
CAL mm	Low risk	8	1.868625	1.8405554	.6507346	.329882	3.407368	0.029
	Intermediate risk	11	2.737909	1.6112340	.4858053	1.655467	3.820351	
	High risk	20	3.481900	1.0596935	.2369547	2.985948	3.977852	
	Total	39	2.941128	1.5088806	.2416143	2.452006	3.430251	
PI	Low risk	8	1.775000	.3732100	.1319497	1.462989	2.087011	0.555
	Intermediate risk	11	1.945455	.4803408	.1448282	1.622757	2.268152	
	High risk	20	1.810000	.3210181	.0717818	1.659759	1.960241	
	Total	39	1.841026	.3774694	.0604435	1.718664	1.963387	
GI	Low risk	8	1.112500	.6978283	.2467195	.529101	1.695899	0.631
	Intermediate risk	11	1.045455	.5610056	.1691495	.668566	1.422343	
	High risk	20	1.250000	.5596051	.1251315	.988097	1.511903	
	Total	39	1.164103	.5810549	.0930433	.975746	1.352459	

TABLE 1

1. **Age (years)**

- **Interpretation:** The mean age is highest in the **Low-Risk group**, slightly lower in **High Risk**, and lowest in **Intermediate Risk**.

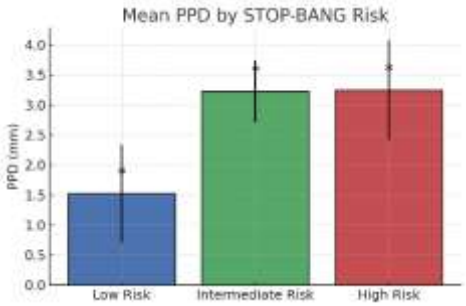
FIG 3



2. **Probing Pocket Depth (PPD in mm)**

- **Interpretation:** PPD increases significantly with risk level, suggesting periodontal deterioration in higher STOP-BANG categories.
- **P-value:** < 0.001 → **Highly statistically significant**. The differences are meaningful.

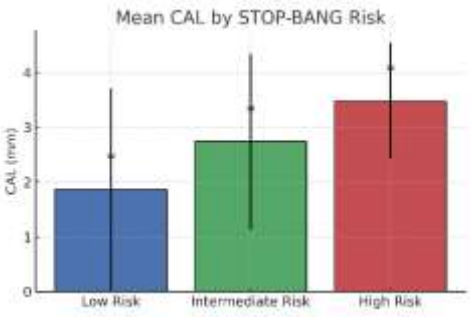
FIG 4



3. Clinical Attachment Level (CAL in mm)

- **Interpretation:** CAL progressively increases with risk group, again reflecting periodontal deterioration with higher STOP-BANG scores.
- **P-value:** 0.029 → **Statistically significant**, especially the difference between **Low and High Risk**.

FIG 5

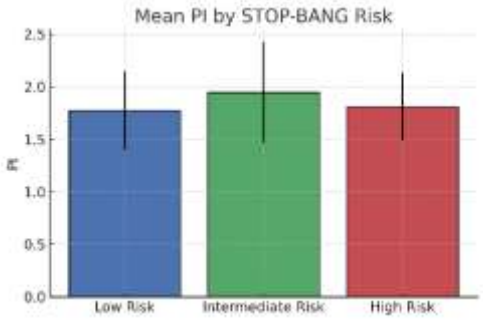


4. Plaque Index (PI)

- **Interpretation:** PI remains fairly constant across all groups. No major pattern is observed.
- **P-value:** 0.555 → **Not statistically significant**.

Natural Resources for Human Health
eISSN: 2583-1194

FIG 6



5. Gingival Index (GI)

- **Interpretation:** GI is marginally higher in the **High-Risk** group, but not substantially.
- **P-value:** 0.631 → **Not statistically significant**.

FIG 7

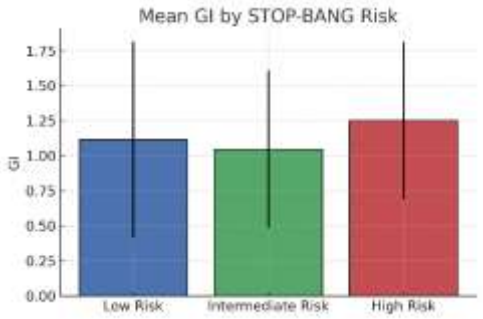


Table 2: Scores of the participants according to The Epworth Sleepiness Scale (ESS)

ESS score	Daytime sleepiness	Participants (n)
0-5	Lower normal	22
6-10	Higher normal	10
11-12	Mild excessive	5
13-15	Moderate excessive	0
16-24	Severe	2

A score of 0 to 5 indicates lower normal daytime sleepiness; 6 to 10 indicates higher normal daytime sleepiness; 11 to 12 indicates mild excessive daytime sleepiness; 13 to 15 indicates moderate excessive daytime sleepiness; and 16 to 24 indicates severe daytime sleepiness

4. DISCUSSION

The objective of the study was to evaluate indices and clinical parameters—including Plaque Index, Gingival Index, Probing Pocket Depth, and Clinical Attachment Level — and to assess the correlation of these parameters associated with the risk of Obstructive Sleep Apnea (OSA) as determined by the STOP-BANG questionnaire

A biological process, sleep is essential for preserving healthy brain function, overall health, and well-being. It also has a major impact on regulating bodily activities. In today's world, getting inadequate sleep has become a serious and widespread issue. The immune system and sleep have a substantial relationship, and healthy immunity depends on getting enough "regenerative" sleep. The body's initial line of defence against microbial infection and tissue injury is the innate immune system, which is made up of monocytes, macrophages, and dendritic cells. Sleep in particular seems to have a close relationship with innate immunity.

The innate immune responses are upregulated when sleep is disturbed, which changes the series of inflammatory processes that should assist control an infection while stimulating healing and recovery.

Shorter sleep duration and poorer quality of sleep are linked to lower immunity and higher inflammatory markers, which have a significant impact on cardiovascular disease, diabetes mellitus, and the development of several infectious dental illnesses, including periodontitis.

Periodontitis is an inflammatory disease that affects the soft tissue and the alveolar bone supporting the teeth. Poor sleep especially in the form of sleep disorders like sleep apnea can worsen periodontal diseases. Sleep and periodontitis are both closely associated as they share inflammatory pathways and show increased levels of pro-inflammatory cytokines. Recent evidences suggests that there is a bidirectional relationship between sleep and periodontal health [4]

Interruptions in breathing when people sleep are a sign of sleep apnea.. A Cross-sectional study by ***Hend et al (2019)*** reported the correlation between sleep duration and periodontal diseases [14] ***Genco et al (2013)*** in his study discussed the risk factors for periodontal diseases and systemic associations including sleep disorders.[15]

A strong correlation between obstructive sleep apnea and periodontitis was observed in a cross-sectional study conducted by ***Yanlong Chen et al (2023).*** The symptoms of periodontitis may be linked to hypoxia caused by obstructive sleep apnea, as low oxygen saturation may be a prediction indicator for the disease.[16]

Meta-analyses and systematic review by ***Qun Zhou et al (2024)*** indicate that neither short sleep duration (SSD, commonly defined as <6 hours) nor long sleep duration (LSD, >8 hours) is consistently associated with periodontitis. However, extremely short sleep (≤5 hours/night) is linked to a significantly higher risk of periodontitis (OR = 1.41) [17]

In a study conducted by ***Mehrizi FK et al (2025)*** Poor sleep quality, as measured by validated indices like the Pittsburgh Sleep Quality Index (PSQI) is strongly associated with chronic periodontitis. However, some research has shown conflicting results, indicating the need for further investigation [18]

In a systematic review done by ***D. Chen et al (2022),*** ESS was used as a standard subjective scale in included studies assessing Sleep-disordered breathing (SDB) symptoms [19]

The present study demonstrates a clear association between STOP-Bang risk groups and various clinical periodontal parameters. Individuals classified as intermediate and high risk according to the STOP-Bang questionnaire consistently show poor periodontal health compared to those in the low-risk group. Specifically, Probing Pocket Depth (PPD) and Clinical Attachment Loss (CAL) are markedly higher in the intermediate and high-risk groups, indicating more severe periodontal breakdown. Plaque Index (PI) and Gingival Index (GI) also tend to be elevated in the higher risk groups, suggesting greater plaque accumulation and gingival inflammation.

These findings suggest that an increased risk of Sleep Apnea, as assessed by the STOP-Bang questionnaire, is associated with poorer periodontal status. This supports the hypothesis that sleep health, particularly the risk of conditions like obstructive sleep apnea, may play a significant role in periodontal disease progression. Therefore, screening for sleep disorders in dental settings could be valuable for early identification and management of patients at risk for periodontal disease. Integrating sleep health assessments into periodontal care may enhance overall patient outcomes

4.1 Limitations

- In patients with OSA, mouth breathing can lead to dry mouth which may increase the periodontal disease risk.
- We have not done staging and grading of periodontal disease (based on 2017 AAP classification) in the present study

- The STOP-Bang Questionnaire lacks specificity, which could lead to false positive results.

5. CONCLUSION

This cross-sectional study highlights a significant association between sleep disorders—particularly the risk of obstructive sleep apnea (OSA) as identified by the STOP-BANG questionnaire—and periodontal health. Individuals classified as intermediate and high risk for OSA consistently exhibited poor periodontal parameters, including increased probing pocket depth (PPD) and clinical attachment loss (CAL), compared to those in the low-risk group. While Plaque Index (PI) and Gingival Index (GI) did not show statistically significant differences, they tend to be higher in those with greater OSA risk, indicating a trend towards poor oral hygiene and increased gingival inflammation among these individuals.

The findings support the growing body of evidence suggesting that sleep health and periodontal disease are interlinked, likely through shared inflammatory pathways and immune system dysregulation. Given the bidirectional relationship between sleep disturbances and periodontal conditions, integrating sleep disorder screening into dental practice could facilitate early identification of at-risk patients and enable more comprehensive management strategies.

In summary, this study underscores the importance of considering sleep health as a potential risk factor in periodontal disease progression. Collaborative care between dental and medical professionals, with routine assessment of sleep quality in patients with periodontal disease, may contribute to improved overall health outcomes and more specifically effective prevention and management strategies for both sleep and periodontal disorders.

Acknowledgement
Department of Periodontology, Department of Oral Pathology, SRDC, SRIHER

Funding
No external funding was received for this study

Conflict of interest statement
The authors declare no conflict of interest

REFERENCES

[1] Newman, M.G., Takei, H.H., Klokkevold, P.R. and Carranza, F.A. (2006) Carranza's Clinical Periodontology. 10th edn. St Louis: Saunders Elsevier. Available at: WorldCat catalogue search.

[2] Grover, V., Malhotra, R. and Kaur, H. (2015) 'Exploring association between sleep deprivation and chronic periodontitis: a pilot study', Journal of Indian Society of Periodontology, 19(3), pp. 304–307. Available at: Google Scholar.

[3] Kale, S.S., Kakodkar, P. and Shetiya, S.H. (2018) 'Assessment of oral findings of dental patients who screen high and no risk for obstructive sleep apnea (OSA) reporting to a dental college—a cross-sectional study', Sleep Science, 11(2), pp. 112–117. Available at: Google Scholar.

[4] Carra, M.C., Balagny, P. and Bouchard, P. (2024) 'Sleep and periodontal health', Periodontology 2000, 96(1), pp. 42–73. Available at: Crossref search.

[5] Silness, J. and Löe, H. (1964) 'Periodontal disease in pregnancy II. Correlation between oral hygiene and periodontal condition', Acta Odontologica Scandinavica, 22(1), pp. 121–135. Available at: Google Scholar.

[6] Löe, H. (1967) 'The gingival index, the plaque index and the retention index systems', Journal of Periodontology, 38(6), pp. 610–616. Available at: Google Scholar.

[7] Listgarten, M.A. (1980) 'Periodontal probing: what does it mean?', Journal of Clinical Periodontology, 7(3), pp. 165–176. Available at: https://doi.org/10.1111/j.1600-051X.1980.tb01960.x.

[8] Barbosa, V.L., Angst, P.D.M., Finger Stadler, A., Oppermann, R.V. and Gomes, S.C. (2016) 'Clinical attachment loss: estimation by direct and indirect methods', International Dental Journal, 66(3), pp. 144–149. Available at: https://doi.org/10.1111/idj.12218.

[9] Papapanou, P.N. et al. (2018) 'Periodontitis: consensus report of workgroup 2 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions', Journal of Periodontology, 89(Suppl. 1), pp. S173–S182. Available at: https://doi.org/10.1002/JPER.17-0721.

[10] Doneh, B. (2015) 'Epworth sleepiness scale', Occupational Medicine, 65(6), p. 508. Available at: https://doi.org/10.1093/occmed/kqv081.
[11] Chung, F., Abdullah, H.R. and Liao, P. (2016) 'STOP-Bang questionnaire: a practical approach to screen for obstructive sleep apnea', Chest, 149(3), pp. 631–638. Available at: https://doi.org/10.1378/chest.15-0903.
[12] Mukherjee, S. and Galgali, S.R. (2021) 'Obstructive sleep apnea and periodontitis: a cross-sectional study', Indian Journal of Dental Research, 32(1), pp. 44–50. Available at: Google Scholar.
[13] Nagappa, M., Liao, P., Wong, J., Auckley, D., Ramachandran, S.K., Memtsoudis, S., Mokhlesi, B. and Chung, F. (2015) 'Validation of the STOP-Bang questionnaire as a screening tool for obstructive sleep apnea among different populations: a systematic review and meta-analysis', PLOS ONE, 10(12), article e0143697. Available at: https://doi.org/10.1371/journal.pone.0143697.
[14] Alqaderi, H., Goodson, J.M. and Agaku, I. (2020) 'Association between sleep and severe periodontitis in a nationally representative adult US population', Journal of Periodontology, 91(6), pp. 767–774. Available at: Google Scholar.
[15] Genco, R.J. and Borgnakke, W.S. (2013) 'Risk factors for periodontal disease', Periodontology 2000, 62(1), pp. 59–94. Available at: https://doi.org/10.1111/j.1600-0757.2012.00457.x.
[16] Chen, Y., Metz, J.E., Gao, H. and Gao, X. (2023) 'Association between obstructive sleep apnea and periodontitis in Chinese male adults: a cross-sectional study', The Journal of Prosthetic Dentistry, 130(1), pp. 80–86. Available at: https://doi.org/10.1016/j.prosdent.2021.11.001.
[17] Zhou, Q., Ye, F. and Zhang, S. (2024) 'Sleep duration and risk of periodontitis—a systematic review and meta-analysis', International Dental Journal, 74(3), pp. 418–425. Available at: https://doi.org/10.1016/j.identj.2024.02.016.
[18] Mehrizi, F.K., Yekani, A.H. and Maybodi, F.R. (2025) 'Association between sleep quality and periodontal status: a case-control study', Journal of Dentistry (Shiraz), 26(1), pp. 69–75. Available at: https://doi.org/10.30476/dentjods.2024.101184.2278.
[19] Chen, D., Meng, Z., Zhao, T., Yu, X., He, H., Hua, F. and Dong, W. (2022) 'Association between sleep-disordered breathing and periodontal diseases: a systematic review protocol', Frontiers in Medicine, 9, article 960245. Available at: https://doi.org/10.3389/fmed.2022.960245.