Duration of Sleep and Periodontal Disease

Christina Valentin

Irena Shlomov

Michael Cheung

DEN1200/E601

https://cainlive.com/5264/sleep-deprivation/

Introduction

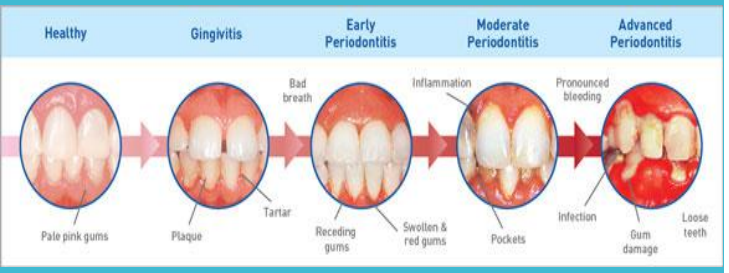
Periodontal disease is the leading cause of tooth loss in adults. Approximately **47% of the U.S. population has periodontal disease,** that is an estimate of **65 million adults** *in the US. (Divisional of Population Health, National Center for Chronic Disease Prevention and Health Promotion, CDC 2009-2010).*

Additionally, our literature review determined that people who suffer from severe periodontal disease experience some alteration in sleep architecture and duration.

Everyone can have a bad night of sleep occasionally, but it is estimated that **50-70 million Americans suffer from sleeping problems, 11% having insufficient sleep every night.** According to the CDC, insufficient sleep is a public health epidemic in the U.S. *(Centers for Disease Control and Prevention. Perceived Insufficient Rest or Sleep Among Adults—United States, 2008).*

Our group decided to investigate the impact that unhealthy sleep behavior has on the periodontium and this will be discussed in the following slides.

Pathway of sleep deprivation and effects on the periodontium?



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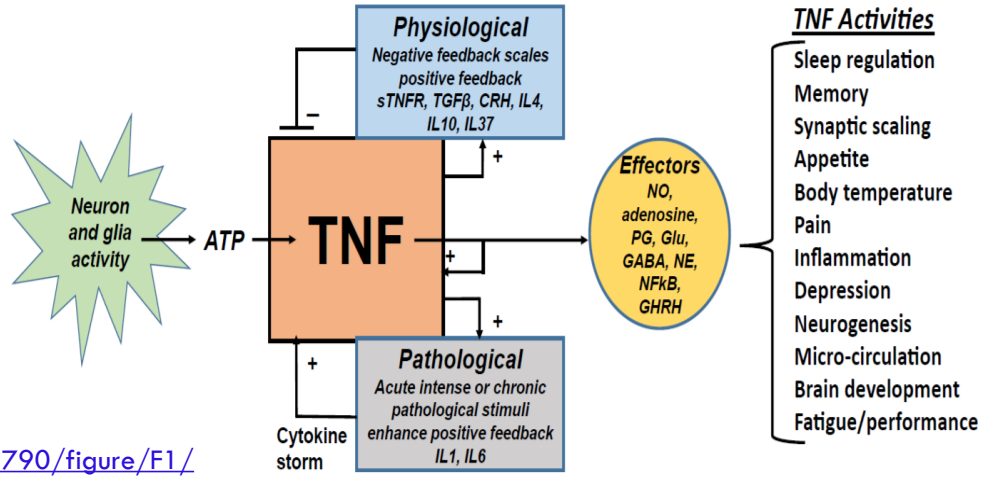
- Cytokines are cells that mediate the interaction between the immune and inflammatory systems.
- Proinflammatory cytokines such as Tumor Necrotic Factor (TNF- alpha) and Interleukin-1 play a major role in the process of periodontal destruction.
- Insufficient sleep causes significantly high levels of monocyte production of Interleukin-6 and TNF-alpha. This increase causes macrophages to have a hyper response, and collectively cause excess periodontal tissue breakdown.
- The alteration in the immuno-inflammatory response which causes collagen metabolism making it more difficult for collagen to be repair or replaced, causing susceptibility to breakdown and poor healing.
- In patients with diabetes mellitus, the pineal gland, is responsible for the release of melatonin, and the regulation of insulin. A disruption is the circadian rhythm reduces the amount of the of melatonin resulting in shorter sleep and the secretion of insulin.

"Association between sleep and severe periodontitis in a nationally representative adult U.S. population" Alqaderi H, Goodman J Max, and Agakuet al. (2019):1,2,5,7, 8,24,26,29,31



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“Association between sleep and severe periodontitis in a nationally representative adult U.S. population.”

Alqaderi H, Goodman J Max, and Agaku et al. 2013

Background: Focused on evaluating the association between sleep duration and periodontal disease. There is a strong association between sleep disturbance and diabetes, cardiovascular disease, and some cancers, due to the adverse effects it has on the metabolic and immune systems.

Demographics:

- A cross- sectional study using data from the 2013-14 US NHANES statistics surveying 3,624 participants with the following criteria.
- 30 years and older.
- With and without pre-existing conditions. Participants were tested for diabetes as an effect modifier.
- Has no history or has previous history or currently smoking
- Sleeps ≥ 7 hours a night without difficulty and those that sleep < 7 hours a night.
- Risk indicators such race, sex, and socioeconomic status varied.

Methods:

- A full mouth periodontal exam was performed to assess clinical attachment loss.
- Measurements from the CEJ and FGM and as well as probing depths (all six sites) on all teeth excluding third molars were recorded. The calculations were rounded to the lowest whole millimeter. (The CAL = CEJ to FGM - probing depths).
- Severe periodontal disease was defined as individuals having ≥ 2 interproximal sites with ≥ 6mm of CAL and ≥ 1 interproximal sites with probing depths of ≥5mm.
- The study conducted multivariate binary logistic regression modeling to test the hypotheses that sleeping >7 hours might be protective from severe periodontal disease. Determining the effect of diabetes on the relationship between sleep and severe periodontal disease, an interaction term variable of the main effect of sleep variable with diabetes variable to examine the effect of diabetes on the relationship between sleep and periodontal disease.

"Association between sleep and severe periodontitis in a nationally representative adult U.S. population."

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Results:

A shorter sleep duration in a US population with statistical findings from the US NHANES of 2013-2014 showed that 73.2% of the participants sleeping 7 hours or less exhibited severe periodontal disease, 11% of the participants had a systemic disease (Diabetes Mellitus).

Conclusion:

Overall, there is a systemic effect on the body. Shorter sleep duration creates a hormonal imbalance and a disruption of the circadian cycle (sleep/ wake cycle, or body clock) resulting in inflammation by activated inflammatory cytokines and proinflammatory cytokines. People with a systemic disease, such as diabetes are 5x's more likely to exhibit severe periodontal disease.

Group	Independent variable	Severe active periodontal disease (n = 317)		No severe active periodontal disease (n = 3,307)		Total (n = 3,624)	*P* value
Sleep duration	>7 hours/night	85	26.8%	1,013	30.6%	1,098(30.3%)	0.1
	≤7 hours/night	232	73.2%	2,294	69.4%	2,526(69.7%)	
Diabetes	Diabetic or borderline	35	11%	325	9.8%	360(9.9%)	0.4
	Not diabetic	282	89%	2,978	90.2	3,260(90.1%)	
Smoking status	Current smokers	58	49%	572	47.3%	630(47.4%)	0.6
	Non-smokers	60	51%	638	52.7%	698(52.6%)	
Age	30 to 34	13	4.1%	440	13.3%	453(12.50)	<0.001
	35 to 49	71	22.4%	1,186	35.9%	1,257(34.69)	
	50 to 64	160	50.4%	963	29%	1,123(30.99)	
	≥65	73	23.1%	718	21.7%	791(21.83)	

https://www.ncbi.nlm.nih.gov/pubmed/31749207;

“Association between quality of sleep and chronic periodontitis: A case - control study in Malaysian population.”

Joe Yin Gan, Vijendra Pal Singh, Wei Ling Liew et al.

Dental Research Journal.Jan- Feb 2019

Background:

- A case control study conducted in Malaysia from March to December 2016.
- The objective of this study was to identify the possible relationship between periodontal disease and the quality of sleep.

Demographics:

- The study included a total of 200 participants, all individuals 21 years or older with a minimum of 16 natural teeth present.
- A 1:1 case–control ratio was used in the study and included 100 cases with periodontitis and 100 controls.

Methods:

- The logistic regression analysis used to test the influences of variables; quality of sleep, age, sex, ethnicity, education, and socioeconomic status.
- The quality of sleep was estimated by Pittsburgh Sleep Quality Index. The index consists 19 self-rated items, grouped into seven domains: subjective sleep quality, sleep latency, sleeps duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction score, each weighted on 0–3 scale, 3 reflected the negative extreme on the scale.
- All individuals had a comprehensive periodontal examination which included pocket probing depth, clinical attachment loss, mean plaque index and mean gingival index, and this consisted of the assessment of all teeth excluding the third molars utilizing the William’s periodontal graduated probe.
- Statistical analysis was done to measure mean, standard deviation, frequency and percentage calculation using statistical software SPSS with 95% confidence interval for mean plaque index (PI), gingival index (GI), probing depth (PD) and clinical attachment loss (CAL).

"Association between quality of sleep and chronic periodontitis: A case–control study in Malaysian population."

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Results:

- The seven-components of the score were summed up to produce a global score, the range was between 0 to 21. Higher scores of PSQI indicated poor quality of sleep. The objective of this study was to identify the possible relationship between periodontal disease and the quality of sleep.
- A global sum of 5 or higher indicated a poor sleeper.
- The mean on periodontal measurement (PI, GI, PD, and CAL) were higher in periodontitis group compare to no periodontitis group.
- Periodontitis group showed well over 50% (56.75%) of people had poor quality of sleep when compared to the control group which was 43.24%.

Table 2: Mean clinical parameters in periodontitis and no periodontitis group

Periodontal parameters (mm)	Mean (SD)		P^a
	Periodontitis	No periodontitis	
PI	1.78 (0.59)	1.08 (0.63)	<0.001
GI	1.79 (0.65)	0.89 (0.88)	<0.001
PD	3.02 (0.69)	1.49 (0.46)	<0.001
CAL	4.02 (1.03)	0.022 (0.81)	<0.001

[a]Independent *t*-test; $P<0.05$ is statistically significant. PI: Plaque index; GI: Gingival index; PD: Periodontal pocket depth; CAL: Clinical attachment loss; SD: Standard deviation

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6340225/

Conclusion:

The study confirmed the statistically significant association between the poor sleep quality and increased incidence of periodontal disease, with the age being the most significant factor.

“The association between periodontitis and sleep duration.”

Mario Romandini, Gioele Gioco, Giorgio Perfetti et al, Journal of Clinical Periodontology February 2017

Background:

- The intention of this groundbreaking study was to evaluate if there is an association between periodontitis and sleep duration.
- The study sample was obtained from the 2012 KNHANES V, a nationwide cross- sectional survey conducted by the KCDC (Korea Centre for Disease Control and Prevention).

Demographics:

- 5812 participants
- South Korean population male and female
- Participants were age ≥ 19 years

Methods:

- Sleep duration was self-reported via survey.
- Thirty trained and calibrated public health dentists assessed the periodontal status.
- Use of multivariate logistic regression analysis to adjust for confounders.

"The association between periodontitis and sleep duration."

Mario Romandini, Gioele Gioco, Giorgio Perfetti et al, Journal of Clinical Periodontology February 2017

Table 2. Adjusted ORs (95% CIs) for the prevalence of periodontitis (both CPI ≥ 3 and CPI = 4 case definitions) according to the sleep duration

	CPI ≥ 3 Case definition				CPI = 4 Case definition			
	Crude	Model 1	Model 2	Model 3	Crude	Model 1	Model 2	Model 3
Sleep duration (1 h increase)	0.97 (0.92–1.03)	1.09* (1.03–1.15)	1.09* (1.03–1.15)	1.15* (1.06–1.24)	0.98 (0.90–1.08)	1.08 (1.00–1.17)	1.08 (1.00–1.17)	1.17* (1.04–1.32)
p for non-linearity	0.98	0.006	0.009	0.005	0.63	0.07	0.034	0.12
Sleep duration category								
≤5 h/day	1 (referent)	1 (referent)	1 (referent)	1 (referent)	1 (referent)	1 (referent)	1 (referent)	1 (referent)
6 h/day	0.93 (0.73–1.19)	1.52* (1.12–2.07)	1.40 (0.96–2.05)	2.06* (1.16–3.66)	1.07 (0.63–1.83)	1.67 (0.97–2.89)	1.69 (0.92–3.10)	2.46* (1.20–5.06)
7 h/day	0.99 (0.78–1.26)	1.66* (1.26–2.18)	1.67* (1.21–2.31)	2.11* (1.27–3.52)	1.09 (0.69–1.73)	1.73* (1.08–2.78)	1.90* (1.10–3.29)	2.66* (1.35–5.25)
8 h/day	0.93 (0.72–1.20)	1.68* (1.24–2.28)	1.64* (1.12–2.41)	2.18* (1.22–3.87)	1.06 (0.65–1.72)	1.76* (1.08–2.87)	1.91* (1.11–3.30)	2.29* (1.13–4.63)
≥9 h/day	0.77 (0.54–1.11)	1.48 (0.99–2.21)	1.53 (0.98–2.41)	2.70* (1.50–4.87)	0.92 (0.50–1.71)	1.57 (0.85–2.91)	1.62 (0.81–3.25)	4.27* (1.83–9.97)

https://www.ncbi.nlm.nih.gov/pubmed/28211083

Results:

- Crude: unadjusted values

Model 1: age; Model 2: age, gender, education, & smoking status; Model 3: age, gender, education, smoking status, and consumption frequency of coffee, tea, chocolate & red wine.

- * Statistically significant
- In the fully adjusted model 3, for everyone more hour of sleep the estimated odds of periodontitis increased 15% (CPI ≥3) and 17% (CPI=4).

Conclusion:

A statistically significant association between sleep duration and periodontitis prevalence was found upon adjusting for the following confounders: age, gender, education, smoking status and consumption frequency of coffee, tea, chocolate and red wine.

DH Role & Significance: **50-70 million people suffer from insufficient sleep** and approximately **65 million adults suffer from periodontal disease, collectively they can cause damage to the periodontium.**

DH Intervention:

- Full medical interview: Provide STOP screening questionnaire (This questionnaire could help identify patients at higher risk for serious, life threatening conditions; e.g. sleep disorders and diabetes) as well as sleep surveys for patients you suspect to have a sleeping disorder.
- Clinical examination and assessment (look for signs of sleep issues; e.g. dark circles around, irritability, appearance, and falling asleep during treatment, and oral abnormalities that can affect sleep, mouth breathing, tongue displacement, enlarged tonsils)
- Refer patient for a dental evaluation by a dental specialist for corrections of dental abnormalities that affect sleep.

EDUCATION:

- Advise how lack of sleep is proven to cause inflammation of the gingiva because of the imbalance of their hormones.
- Educate patients that adapting healthier sleeping patterns.
- Information about sleep can potentially help identify other underlying systemic diseases.

DENTAL HYGIENE CARE PLAN

- Collaborate with medical provider to determine the best course of action. There is an increase in willingness of dental and medical professionals working together to provide the best care for their patients.
- Plaque biofilm debridement; During assessments if there is no plaque biofilm seen but there is substantial inflammation, start a discussion with patient about sleep hygiene, diet, and evaluation by their physician for the possibility of an underlying disease.
- Recare appointments should be set to every 3 months to maintain health of periodontium.
- Reassess every visit to see what has improved and what hasn't and find a new method that will be more beneficial for the patient

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Sleep Hygiene and Nutritional Advice:

Nutritional Advice:

Dental Hygienist should inform patients on ways to improve their eating habits by…

- As dental hygienists we can reinforce healthy eating habits as it relates to oral health and sleep.
- Avoiding stimulants such as caffeine, alcohol, and nicotine close to bedtime.
- Inform patients that eating healthy allows our body to absorb proper nutrients that provide the brain with a chemical environment that needs to be produced to maintain adequate sleep.

Dental hygienists should inform patients on ways to improve their sleeping habits by…

Sleep Hygiene- is the term used to describe good sleep habits

- Avoid consumption of heavy foods, which can cause heartburn and indigestion, disrupting sleep.
- Establishing a regular bedtime routine; helping your body recognize bedtime.
- Making sure that the sleep environment is pleasant. A comfortable pillow and mattress are important as well as minimizing the use of technology/electronics (cell phone, T.V., computer…etc).
- Getting daily exposure to sunlight as well as darkness; it helps maintain a sleep-wake cycle.

For more information on sleep hygiene please visit the link below

https://www.sleepfoundation.org/articles/sleep-hygiene

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