

Chrono Dentistry and the association between shift work and oral health in a representative sample population: An Internet survey

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ABSTRACT

Background: Most physiological processes in mammals display circadian rhythms that are driven by the endogenous circadian clock. Disruptions of the circadian clock have been associated with nearly every major human disease. With that as the central idea, this study attempted to see the variations in the form and function of the oral cavity with respect to the circadian cycle by comparing the oral health problems of daytime-only workers with those who worked night shifts.

Aims: To study the relationship between the circadian clock and oral diseases by comparing the oral health problems and lifestyle of daytime-only and night shift workers.

Methods and Material: A pre-validated questionnaire containing 12 close-ended questions was circulated among 40 night and 40 day shift workers. Appropriate statistical analysis was carried out.

Results: Increased incidence of extractions and decay was found in night shift workers. Of all, 65% of the day shift workers had lost a few of their teeth to decay and extractions while the same was found in 70% of the night shift workers. Pain in teeth was also found to be prevalent in night shift workers with 80% of the participants claiming that they experienced pain in their teeth while 60% of the day shift workers experienced such pain. 90% of the participants claimed to be non-smokers in the day shift work. In the night shift, 52.5% of participants were current smokers. Smoking was prevalent among night shift workers.

Conclusions: The results of this study show a clear relationship between night shift work and oral health problems. Hence, stronger measures to provide oral health maintenance support for night shift workers are needed.

Key words: Biological clock, circadian rhythm, day shift workers, night and day cycle, night shift workers, oral effects of the biological clock

INTRODUCTION

The light/dark cycle generates biological rhythms within an organism. The body's biological clocks

control the circadian rhythm. The “master” clock is located in the hypothalamus and is called the suprachiasmatic nucleus (SCN) whereas all the other clocks are referred to as peripheral clocks. The central clock is light-responsive while the peripheral clocks cannot perceive light but respond to the central clock or independently to other physiological stimuli, such as feeding.^[1] Most physiological processes in

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Submitted: 13-Jul-2023

Revised: 14-Oct-2023

Accepted: 19-Oct-2023

Published: 30-Apr-2024

Access this article online

Quick Response Code:



Website:

<https://journals.lww.com/jdyu>

DOI:

10.4103/jdryruhs.jdryruhs_130_23

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How to cite this article: Gupta RM, Jha SM, Nimma V. Chrono Dentistry and the association between shift work and oral health in a representative sample population: An Internet survey. J YSR Univ Health Sci 2024;13:42-7.

mammals display circadian rhythms driven by the circadian clock. It therefore becomes imperative to study the relationship between this circadian clock and the various diseases affecting mankind. Clock gene expression has been found in several epithelial craniofacial tissues, mainly in basal cells of oral epithelium surrounding dental roots.^[1] Ischemic stroke, breast cancer, diabetes, hypertension, and obesity have been shown to have an increased incidence in night shift workers.^[2-6] Han *et al.*^[7] found an association between shift work and periodontitis in their investigation of the relationship between shift work and oral health.

These studies suggest that circadian rhythm also plays an important role in the maintenance of the form and function of the oral cavity tissues.

Conventional dental treatments and procedures are all based on solving the problems present in the vicinity of the oral cavity. These do not show us the bigger and more important picture. In the present era, dentistry has advanced to such a scale that every patient receives a customized treatment plan suited to his/her individual needs. Hence, it becomes imperative to look at other factors that can influence oral health such as the circadian rhythm, nutrition, systemic health, and many others.

This study aimed to see the variations in the form and function of the oral cavity with respect to the circadian cycle by comparing the oral health problems and lifestyles of daytime-only workers with those who worked night shifts.

SUBJECTS AND METHODS

Participants

This online survey was conducted in Mumbai during the 2020–2021 period. A total of 80 participants were included in the study.

Selection of participants

A pre-validated questionnaire, in English and the local language, containing 12 close-ended questions about the demography, smoking status, and general oral health was circulated among 40 night-shift workers (NSWs) and 40 day-shift workers (DSWs) using a Google Form, and the results were obtained. To reduce the social desirability bias, the survey was

kept anonymous and the participants were assured that their responses would remain confidential. The questions were framed in an indirect manner to reduce the pressure to reply in a socially desirable way. The questionnaire focused on longitudinal data to minimize recall bias.

These registrants were invited to participate in this survey and provided their informed consent after which the screening survey began. The registrants were given 2 weeks to fill out the form. The registrants filled out the questionnaire and their responses were collected. The study analyzed the data of only those participants who submitted completed forms. Hence, the data from 80 (40 DSWs and 40 NSWs) respondents was collected and analyzed in this study.

Inclusion/Exclusion criteria of participants

The study included day-shift and night-shift participants who could read and respond to an online questionnaire. NSWs were defined as those working on a shift rotation schedule that included a 10 p.m. to 5 a.m. shift. DSWs were defined as non-shift workers who only worked during the daytime. Inclusion criteria included workers above 30 years of age. Exclusion criteria included individuals under 30 years of age, those with syndromic diseases, those unable to complete an online survey, individuals with cognitive disorders, and those who did not provide consent for participation. A total of 40 DSWs and 40 NSWs were analyzed in this study. Participants were divided into two age groups (30–49 and 50–69).

Ethical clearance

Ethics committee approval was not taken as it was an internet survey with no element of patient operation or in person interaction.

RESULTS

A total of 40 DSWs and 40 NSWs were assessed. The assessment was started by noting the age of the respondents in both groups. In DSWs, 70% of the respondents belonged to the 30–50 years age group whereas the rest 30% were 50 years and above. When the ages of the NSWs were assessed, it was found that only 10% of the respondents were in the 50 years and above category meanwhile the rest belonged to the younger age group.

The next question was about the brushing habits of both groups. It was seen that 40% of DSWs brushed their teeth twice daily whereas 37.5% did the same in NSWs [Table 1].

A question on smoking status was asked to which 10% of the DSW agreed that they smoked in the past and 90% of the participants claimed to be non-smokers. In the night shift, 52.5% of the participants were smokers or smoked in the past and the remaining 47.5% were non-smokers [Table 2].

Next, the oral health status of the two groups was assessed in which the first question was aimed at knowing the number of missing teeth in their oral cavities. In DSWs, 65% of the respondents had some number of teeth missing whereas the rest 35% had no teeth missing. In NSWs, 70% of workers had one or more teeth missing and 30% had no teeth missing.

When asked about hypersensitivity (pain) from consuming hot or cold food substances, 5% of DSWs said that they always experienced pain, whereas 22.5% of DSWs reported having pain sometimes. 30% said that they never experienced such pain. On the other hand, 12.5% of NSWs said that they experienced such pain very often, 2.5% said that they always have such pain and 30% said sometimes [Graph 1].

When questioned about pain in their teeth, 20% of DSWs said they sometimes experience pain in their teeth with 40% saying rarely and 40% saying never. In NSWs, 10% of responders said that they experienced pain in their teeth very often, 27.5% said that they experienced pain sometimes, 42.5% rarely, and 20% said never [Graph 2].

Next up, the participants were asked about how often they experience pain in their gingiva to which 10% of the day shift responders said sometimes and the rest swayed between rarely and never. In the night shift, 2.5% said always, 5% said very often and 22.5% responded sometimes [Graph 3]. When asked about the frequency of bleeding from gums, 2.5% of DSW said very often whereas 15% said sometimes. In the night shift, 10% said that they always have bleeding gums, and 5% said very often, and 25% said sometimes [Graph 4].

The last question in the survey was about the frequency with which the respondents experienced

swelling in their gums; 17.5% of DSWs responded with sometimes, 37.5% said rarely and 45% said never. In the night shift, 2.5% of NSWs experienced swelling always, 10% responded that they experienced it very often, 22.5% said sometimes and the rest oscillated between rarely and never [Graph 5].

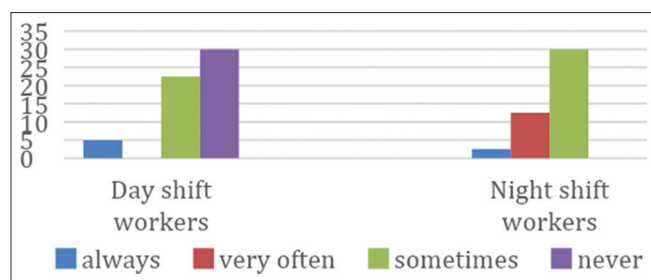
DISCUSSION

The oral cavity is said to be the pathway to the human body. Poor oral and dental health is universally recognized as having a profound effect on general health, well-being, and quality of life, while oral conditions are the most common conditions of humankind.^[8,9] Therefore, novel ways to handle and treat oral conditions more efficiently are necessary. The circadian rhythm can provide a potential answer.

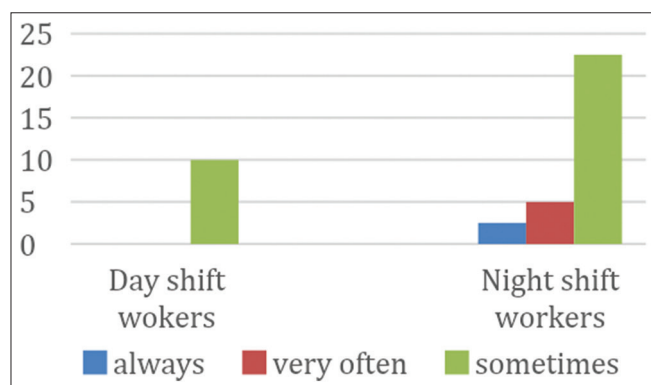
Most physiological processes in mammals display circadian rhythms that are driven by the endogenous circadian clock. It has been shown that disruptions of the circadian clock have been associated with nearly every major human disease, and many of the most commonly used medications target circadian genes.^[10,11] With that as the central idea, this study attempted to see the variations in the form and function of the oral cavity with respect to the circadian cycle by comparing the oral health problems of daytime-only workers with those who worked night shifts.

Age was the first factor assessed and it was found that 90% of participants in the night shift group belonged to the age group of 30–50 and the rest 10% were 50 and above, whereas the opposite trend was evident in the day shift wherein 70% of the respondents belonged to the 30–50 years age group wherein the rest 30% were 50 years and above. This may be due to the strenuous nature of the night shift which can be handled better by a younger age group. Night shift also has the added advantage of a better pay rate attracting more young workers.

Gauging the oral hygiene habits of the DSW and NSW groups was the first major aspect that this study concentrated on. The study found that NSWs had fewer respondents who brushed their teeth twice daily as compared to DSWs. This finding can be attributed as a potential reason behind the increased findings of decay in the night shift group. This is corroborated by a study by Pita-Fernández *et al.*^[12] in which he found



Graph 1: Pain in teeth on consuming hot and cold substances



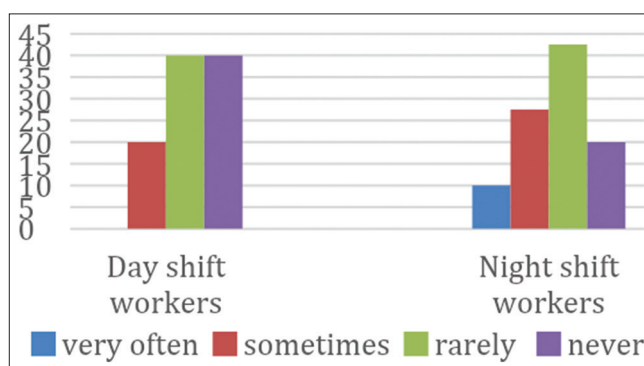
Graph 3: Pain in gums

out that the children who never brush their teeth have 40% of early caries, while those who brush their teeth several times a day have 15.3%, thus knowing the oral hygiene habits of the two groups was important.

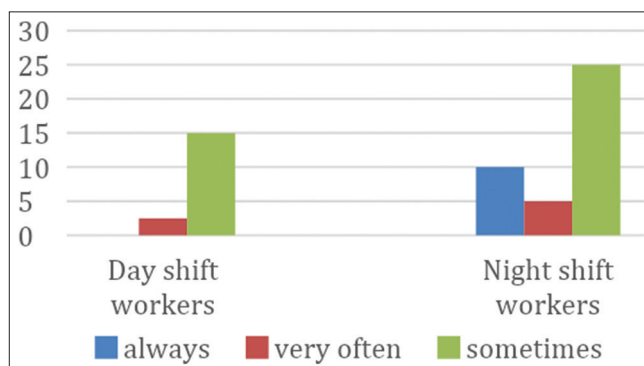
In the night shift group, 52.5% of the respondents smoked (past and present) as compared to the day shift group, in which only 10% (past and present) were smokers. The increased incidence of smoking in the night shift group can be attributed to the fact that the night shift group has a younger working population. The same is highlighted in the Morbidity and Mortality Weekly Report (MMWR) by the Centre for Disease Control and Prevention (CDC) which says that Current cigarette smoking rates decrease with increasing age.^[13]

Increased smoking prevalence in NSWs can also explain the higher rate of tooth decay in the night shift group. In a study by Bernabé *et al.*^[14] the relationship between daily smoking and caries increment in adults was investigated. The resultant finding was that daily smoking was related to the net decayed teeth increment.

It was seen that there were 65% DSWs with one or more teeth missing with 70% in the NSW group. On further examination, it was seen that 22.5% of



Graph 2: Pain in teeth



Graph 4: Bleeding from gums

TABLE 1: AGE OF PARTICIPANTS AND BRUSHING FREQUENCY

	Day shift workers	Night shift workers
Age		
30-50	70%	90%
51 and above	30%	10%
Brushing twice daily	40%	37.5%

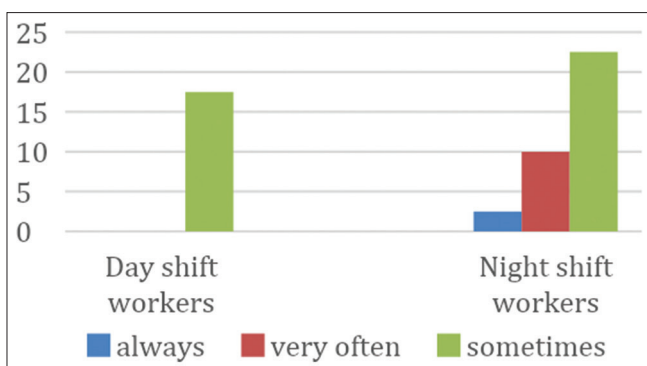
TABLE 2: SMOKING STATUS

Smoking Status	Smokers (Present and Past Smokers)	Non-smokers
Day shift workers	10%	90%
Night shift workers	52.5%	47.5%

TABLE 3: DATA ON MISSING TEETH AND OCCURENCE OF PAIN

	Day Shift Workers	Night Shift Workers
Teeth Missing (One or more than one)	65%	70%
No teeth missing	35%	30%
Pain from consuming hot or cold food substances (Hypersensitivity)	27.5%	45%
Frequency of pain in the teeth (without any stimulus)	20%	37.5%

DSWs and 40% of NSW reported to have missing teeth due to extractions. Similarly, the night shift group had 37.5% of participants who said that they



Graph 5: Swelling in gums

TABLE 4: DATA ON THE PERIODONTAL HEALTH OF PARTICIPANTS

	Day shift workers	Night shift workers
Pain in the Gingiva	10%	30%
Frequency of bleeding Gums	17.5%	40%
Swelling in the gums	17.5%	35%

experienced pain in their teeth as compared to the 20% in the day shift group [Table 3]. This general trend of poorer oral health in the night shift group may potentially be linked to undiagnosed systemic conditions as NSWs who work long hours are particularly at higher risk of acquiring systemic diseases such as diabetes as shown by Vimalananda *et al.*^[4] In their study, it was seen that a long duration of shift work resulted in an increased risk of diabetes after controlling factors like lifestyle and Body Mass Index (BMI). Several studies have been conducted to study the relationship between systemic conditions and diseases of the oral cavity. Jones, in his paper, reported an elevated risk of caries due to diabetes mellitus (DM).

With respect to the gingival health of both groups, it was found that 30% of NSWs and 10% of the DSWs experienced gingival pain, while 17.5% of DSWs and 35% of NSWs experienced gingival swelling [Table 4]. Irregularity of the circadian rhythm may be a big reason behind this. Strengthening this line of thought Leproult *et al.*^[15] reported that circadian misalignment is associated with increased insulin resistance and inflammation. These factors can explain the reason behind the increased incidence of Gingival pain and swelling in the night shift group.

Limitations

There were several limitations in this study, the first being its geographical scope. The study's geographical

scope is limited to Mumbai, which may raise concerns about the generalizability of the findings to other regions. Socioeconomic and cultural factors may prove to be roadblocks to the general applicability of the findings. The second limitation of the study was that the data used in this study was self-reported.

Despite these limitations, the study can still serve as a proof of concept with the potential for wider applicability.

CONCLUSION

In conclusion, a clear relationship between night shift work and oral health problems can be seen through this study. Hence, oral health maintenance is very important for NSWs. Regular dental checkup camps should be organized for NSWs. Chronic indulgence in deleterious habits such as tobacco consumption should be minimized. Appropriate knowledge about night shift work and its relation to oral health should be provided.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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