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CASE REPORTS

Resolving delayed sleep-wake phase disorder with a pandemic: two case reports

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Two patients with delayed sleep-wake phase disorder (DSWPD) demonstrated improvement in sleep quality and duration, reduction in symptoms, and elimination of the need for hypnotic or stimulant medications after changing their sleep schedules in response to the coronavirus disease 2019 (COVID-19) pandemic lockdown work schedule changes. These cases highlight the impact of work schedules on patient health and raise questions about approaches to workplace schedule requirements postpandemic.

Keywords: circadian, delayed sleep-wake phase, COVID-19, pandemic, sleep diary

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BRIEF SUMMARY

Current Knowledge/Study Rationale: The COVID-19 pandemic has had a profound effect on work and sleep schedules, with some reports of trouble sleeping from stress or mood disorders, while others show changes in sleep timing and duration. The schedule changes resulting from the pandemic may benefit people with circadian rhythm sleep disorders who were previously unable to align work and sleep schedules with their internal circadian cycle, even with multiple therapeutic strategies.

Study Impact: These cases demonstrate the benefits of improving synchronization between sleep schedule and circadian rhythms, with elimination of symptoms and need for pharmacotherapy. In addition, we show a method for utilizing positive airway pressure machine timing data as a sleep diary alternative.

INTRODUCTION

Many reports on the impact of the coronavirus disease 2019 (COVID-19) pandemic on sleep have focused on negative consequences, including insomnia ("coronasomnia"[1]) related to situational stress and mood disorders or work schedule changes.[2] Standard sleep questionnaires documented increased sleep disturbances, with increased sleep latency, reduced sleep efficiency, and increased sleep medication use during quarantine.[3]

For some people, the transition to home-based work or school and the ability to set their own schedule may improve sleep, including increased sleep episode duration.[3,4] Patients with circadian rhythm sleep-wake disorders, in whom adherence to work- or lifestyle-imposed schedules has put their sleep schedules in conflict with their circadian-based sleep-wake preferences, would be expected to have improved sleep when freed from the time constraints imposed by most work schedules. Higher sleep regularity, a measure of sleep-wake schedule stability calculated by the Sleep Regularity Index (SRI), has been associated with better academic performance and lower cardiovascular disease risk.[5,6] We report 2 cases of delayed sleep-wake phase disorder (DSWPD) in which pandemic-related schedule changes led to improvement in sleep quality, duration and regularity, and resolution of symptoms.

REPORT OF CASES

Patient 1

Patient 1 is a 58-year-old man with lifelong complaints of difficulty falling asleep and daytime sleepiness. As long as he could remember, he stayed up late because he would not fall asleep if he went to bed earlier and had a hard time getting up for school or work. He had no energy and would fall asleep during the daytime. He was diagnosed with chronic fatigue syndrome at age 18 years.

He was diagnosed with obstructive sleep apnea (OSA), periodic limb movement disorder, and DSWPD following in-laboratory polysomnography at a prior sleep clinic evaluation at age 38 years. He was unable to tolerate continuous or bilevel positive airway pressure (PAP) therapy and was switched to oral appliance therapy. Trials of multiple sedating medications to improve sleep onset were unsuccessful. Subsequently, he was started on stimulant therapy, initially modafinil and then methylphenidate, to improve daytime alertness.

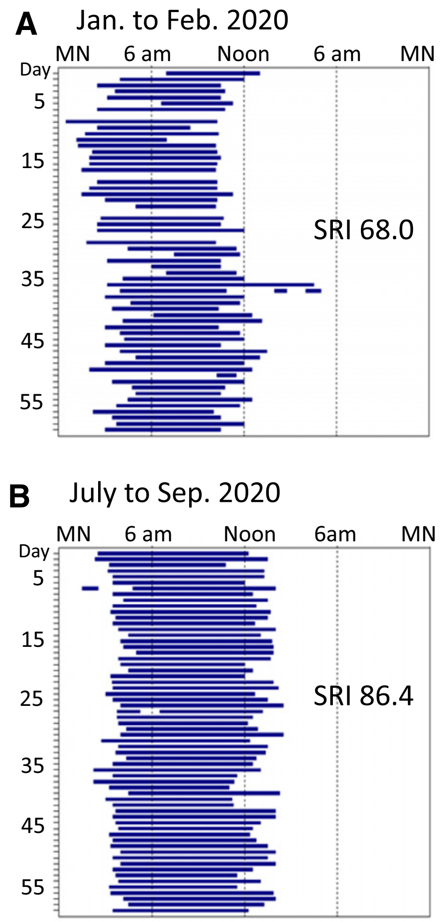
At his first visit to our clinic, he reported continued difficulty getting to sleep at his desired time, despite bedtime use of 5 mg zolpidem and 0.5 mg lorazepam, and he was taking 18–36 mg of methylphenidate daily to stay alert. He went to bed between 1:30 AM and 2:30 AM, falling asleep in under 30 minutes if he took the sleeping medication and getting out of bed between

10:00 and 11:00 AM, for about 8 hours of sleep per night. Repeat sleep study with his oral appliance showed persistent OSA and periodic limb movement disorder.

Evening melatonin (0.5 mg, Pure Encapsulations, Sudbury, MA) 1 hour prior to target bedtime, and morning bright light, ~10,000 lux white light upon awakening for 20 minutes, were prescribed to advance his circadian phase. Afterwards, he reported going to bed between 1:00 and 2:00 AM and sleeping 7–8 hours/night. He was switched to an auto-titrating PAP device at 8–15 cm H_2O and demonstrated good adherence to therapy, resulting in elimination of snoring and OSA (residual apnea-hypopnea index = 3.7 events/h from the machine download and average use of 7:14 hours/night, Figure 1A). Dopamine agonist therapy was initiated with ropinirole for periodic limb movement disorder, after which his restlessness symptoms resolved and leg movements were almost eliminated. Despite increasing sleep time, eliminating sleep fragmentation (ie, from decreased apnea-hypopnea index and periodic limb movement disorder), and advancing sleep timing, he continued to have difficulty with maintaining a regular schedule and required stimulants to maintain self-reported daytime alertness.

The patient worked evenings in the box office of a local theater, which closed during the COVID-19 pandemic. He started working from home and, with no commute or demand to follow a set work schedule, he set his own sleep-wake schedule. He stopped the circadian advancement therapy, did not go to bed until sleepy, and slept as long as desired. PAP download showed a delay in his sleep timing with average bedtime of 3:30 AM and rise time between noon and 1:00 PM. His sleep regularity improved (ie, increase in SRI from 68.0 to 86.4 [a score of 100 means the individual sleeps and wakes at exactly the same times each day while random sleep and wake times would score 0]). On this schedule, with prolonged sleep (average PAP use of 8:53 hours/night, Figure 1B) and elimination of OSA and periodic limb movement disorder, his sleepiness finally improved. He was able to wean off stimulants and sleeping medications and maintained improved self-reported alertness.

Figure 1—PAP device download data from patient 1.



Data collected via modem from the patient's PAP device are displayed. Data are from prior to the pandemic with an irregular schedule, Sleep Regularity Index (SRI) = 68.0 **(A)** and during the pandemic with regularized schedule and increased total use time, SRI = 86.4 **(B)**. Data are plotted from midnight to midnight on each line with consecutive days below each other; blue lines indicate times when PAP was used. PAP = positive airway pressure.

Patient 2

Patient 2 is a 27-year-old man who presented to the sleep clinic with a complaint of difficulty falling asleep and excessive daytime sleepiness. Since young adulthood, he would go to bed at 2:00 AM and have significant trouble waking up for school. In college, he scheduled all classes for the afternoon. After college, he worked for an engineering company and had to wake up at 8:30 AM. He experienced dizziness, headaches, and tachycardia upon awakening and daytime sleepiness. His company moved locations, prolonging his commute. This necessitated an even earlier wake time of 5:45 AM, which exacerbated his symptoms. At night, he played in a basketball league from 9:00 PM to 10:00 PM and ate dinner at midnight. He spent more than 30 minutes trying to fall asleep. He averaged 5–6 hours of sleep per night and awoke later on the weekends, usually around 10:00 AM, demonstrating social jet lag.

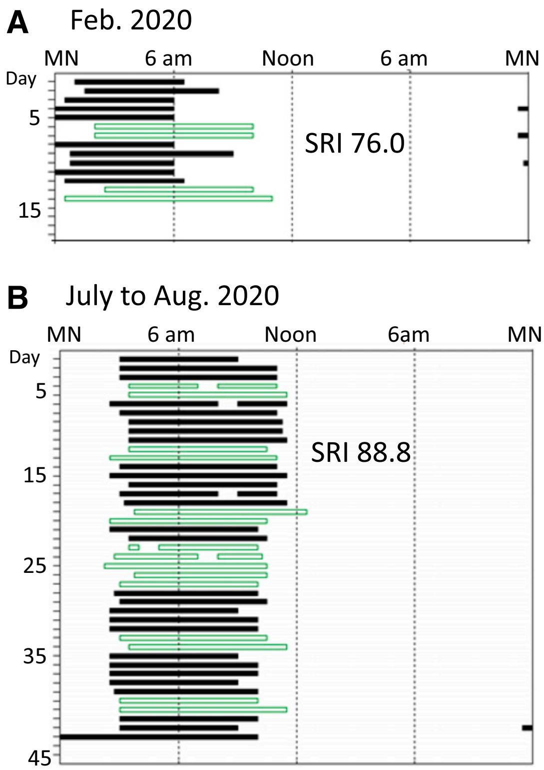
During his visit, he was instructed to advance his sleep schedule to an earlier hour. Supplemental melatonin, 0.5 mg, was prescribed at 8:00 PM with a target bedtime of 10:00 PM and wake time of 6:00 AM followed by morning light exposure.

In response to the COVID-19 pandemic, he began to work from home in June 2020, choosing to start work at 11:00 AM. At follow-up in August. he revealed he had not advanced his sleep-wake schedule to an earlier hour due to the later work start time and the elimination of commuting time. His sleep logs (Figure 2) from July–August showed he was consistently going to sleep at 2:30 AM and waking up at 10:00 AM. He continued to exercise during the week as before. His sleep latency was now 15 minutes. His SRI improved from 76.0 to 88.8. The increased sleep duration led to resolution of the daytime sleepiness. Worried that work from home would end and he would need to resume an early morning schedule, he asked for a medical disability letter requesting accommodation to allow him to maintain his later work schedule.

DISCUSSION

These 2 cases highlight an unexpectedly positive consequence of the disruption caused by the COVID-19 pandemic. Two patients

Figure 2—Sleep diary data from patient 2.



Data are plotted from midnight to midnight on each line with consecutive days below each other. Bars indicate time of sleep episodes: black for nights before a work day and green for nights before a nonwork day. Data are from prior to the pandemic with irregular schedule showing delay in sleep time on nonwork nights, Sleep Regularity Index (SRI) = 76.0 **(A)** and during the pandemic with regularized schedule and increased total sleep time, SRI = 88.8 **(B)**.

with DSWPD experienced improved sleep and reduced symptoms when freed from work constraints that required them to sleep at times when they would have difficulty sleeping. Going to bed when sleepy and waking when fully rested allowed these patients to mitigate 3 harmful effects of their irregular schedules: insufficient sleep from ineffectively treated insomnia, irregular sleep-wake schedules marked by social jet lag, and chronic hypnotic and/or stimulant use.

The improvement in their sleep was demonstrated quantitatively by improvement in their SRIs and total sleep durations calculated from sleep logs. The sleep log data for Case One was generated from a novel use for data from PAP therapy devices in compliant patients, using the data as a sleep diary substitute. This allowed monitoring of sleep timing in real time and without patient input. Sleep-wake schedules are most commonly measured with sleep diaries or actigraphs, wearable activity monitors that detect motion with accelerometers and use lack of activity as a surrogate for sleep with an accuracy > 80%.[7] Utilization of PAP device data in patients adherent to therapy may provide an alternative to costly actigraphs for use in people with comorbid sleep disorders. While limited to patients with OSA who are compliant with PAP therapy and requiring validation in a larger sample of patients, the remote monitoring capabilities of the devices may provide an easy method to monitor sleep schedules in large numbers of patients on this treatment.

Even for those without circadian rhythm disorders, sleep during COVID-19 restrictions has trended toward delayed timing and increased time spent in bed. In a study conducted in March 2020,[8] bedtime was delayed by 41 minutes and participants spent an average of 26 minutes longer in bed. This suggests that prepandemic schedules resulted in insufficient sleep for a large segment of the population, which correlates with population studies showing more than a third of adults getting less than the recommended 7 hours of sleep.[9]

These findings have significant implications for post-COVID-19 work schedules. Insufficient sleep and shift work have negative consequences on health and mood. Later sleep timing (and increased sleep duration) on nonwork days relative to work days is known as social jet lag; it is associated with increased risk of obesity, metabolic syndrome, diabetes, and delay in circadian phase.[10] Shift work can cause misalignment between the output of the central circadian pacemaker and the required sleep-wake schedule. This often results in disturbed daytime sleep and impaired wakefulness during night work. Night workers experiencing insomnia during displaced sleep or excessive sleepiness during work hours are classified as having shift work disorder and treated with sleeping medications and stimulants. In the 2 cases presented here, the presence of DSWPD exacerbated the impact of their work schedule, resulting in a second sleep disorder diagnosis of shift work disorder. People with DSWPD and shift work disorder have higher rates of substance use and obesity and poorer control over diabetes. A person with DSWPD will have great difficulty trying to follow a 9:00 AM–5:00 PM work schedule, especially if an early rise time is required for commuting and/or family obligations. With increasing numbers of workers doing shift work or extended work shifts, there may be legal ramifications for how to accommodate people with a disability from their schedule-induced sleep disorders, including consideration of whether circadian rhythm disorders should be considered as disabilities requiring accommodation under the Americans with Disabilities Act. To date, these schedule-related problems have been managed by trying to shift the individual's circadian phase to accommodate the work schedule. Though some jobs require round-the-clock presence (ie, hospital workers, first responders), the pandemic has demonstrated that many jobs can be accomplished successfully with alternate work schedules, suggesting that another potential treatment pathway is through thoughtful work schedule redesign. DSWPD patients, as an alternative to pharmacotherapy, could consider seeking jobs with evening or nighttime shifts and/or work with employers to increase flexibility in work schedules.

The ability of some employees to follow a schedule more aligned with their internal circadian rhythms during this pandemic has been a boon for improving sleep in some people. These findings challenge society to preserve the benefits of flexible work scheduling when the public health emergency resolves.

ABBREVIATIONS

DSWPD, delayed sleep-wake phase disorder

OSA, obstructive sleep apnea
PAP, positive airway pressure
SRI, Sleep Regulatory Index

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