

Circadian Rhythm Sleep Disorders: An Overview

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Takeaways

- Not only is the internal clock shifted, but the patient is unable to shift it back.
- These disorders disrupt people's lives and may have other health consequences.
- Treatments are often ineffective.
- When performing a sleep study, the time should be scheduled to conform to the patient's internal clock.

Introduction

I have delayed sleep phase disorder (DSPD). That means I am unable to fall asleep until very late at night and normally sleep very late in the morning. My sleep doctor sent me to a sleep lab to get a polysomnogram. The lab techs insisted I try to sleep at midnight, and they woke me at 5 a.m. The sleep doctor then informed me that my problem was I wasn't getting any deep sleep. No, not between midnight and 5 a.m. — I could have told her that.

Definitions^{1,2}

Circadian rhythms are physiological, and behavioral changes in the body that occur on roughly a 24-hour cycle. Examples are sleep, alertness, core body temperature, appetite and many hormones.

Circadian rhythm sleep disorders (CRSDs) are neurological disorders in which the sleep-wake cycle is out of sync with the day-night cycle. We focus on these three: delayed sleep phase disorder, advanced sleep phase disorder and non-24-hour sleep-wake disorder.

Delayed sleep phase disorder (DSPD) is characterized by an inability to fall asleep until very late at night, with the resulting need to sleep late in the morning or into the afternoon.

Advanced sleep phase disorder (ASPD) is the opposite. It is characterized by falling

asleep very early in the evening and waking up in the very early morning hours, unable to sleep further.

Non-24-hour sleep-wake disorder (non-24) (also called free running disorder) is a condition in which a person's day length is significantly longer than 24 hours, so that sleep times get later each day, cycling around the clock in a matter of days or weeks.

Two Factors

There are two factors to these disorders. One is that the body's internal clock is shifted with respect to the external day-night cycle. The other is that it is difficult or even impossible to shift back to a normal sleep schedule.³ That is the part that people who have not experienced these disorders find so difficult to understand.

Even when physically tired or sleep deprived, these people often cannot make up for lost sleep outside of their hardwired sleep times.

Most people can adjust their sleep times with sufficient discipline. We cannot.

Prevalence

A careful survey of 10,000 adults concluded that 0.17% had clinically diagnosable DSPD.⁴ That's about one in 600, or half a million Americans. Three times as many as have narcolepsy. Yet it often goes undiagnosed, in part because people, even doctors, are unaware of these disorders.

It is well-known that circadian rhythms often shift later during adolescent years,⁵ so DSPD is much more prevalent among teens.

The same survey⁴ didn't find any cases of ASPD. Additionally, ASPD is less frequently diagnosed because it doesn't cause patients to be late for work or school, so they are less likely to seek medical help.

It is estimated that over half of all totally blind people have non-24. However, some sighted people also suffer from non-24. Sighted non-24 was thought to be extremely rare, but our own survey⁶ and discussions on social networks suggest it is more common than previously thought.

Impact

Damned if you do.

Most people with these disorders try to live on a normal schedule. School or work requirements enforce this. These people often get less than six hours of sleep a night⁶ and become sleep deprived. Many report sleeping through loud alarm clocks. They are often late for work and often lose their jobs.

Most people can adjust their sleep times with sufficient discipline. We cannot.



These folks drag themselves through one day after another. The struggle with fatigue, day in and day out, is wearing and can lead to depression. At best, these people are not able to function well. Like most sleep-deprived people, they are at greater risk of automobile accidents.

In the long term, they are destroying their health. The constant sleep deprivation can lead to cancer, diabetes, fibromyalgia, depression and other illnesses.^{7,8}

Damned if you don't.

Some people have been happier and healthier sleeping on their bodies' preferred schedules. However, they have great difficulty finding regular work. Some manage by doing freelance work if they have marketable skills. But when living on their bodies' preferred schedules, they also have difficulty scheduling appointments, getting repairs on their homes or even being available to their children when needed.

In addition, they often lack support from family, friends and the medical community, and are called lazy and undisciplined by those who do not understand the severity of these disorders. Patients not only have to deal with their disorder, but they have to fight with the people who should be supporting them.

It has been suggested — without supporting data — that people with circadian rhythm sleep disorders who sleep on their bodies' preferred schedule sleep well, wake up refreshed and feel alert during their awake time. Anecdotal evidence and our own survey data⁶ contradict that. Many of us wake up groggy, struggle for hours to wake up fully and are still not at peak alertness.

Personal Experiences

Back when I was attending college, and later working a daytime job, I was always slightly depressed, and twice had major depressive episodes lasting many months, with suicidal feelings. After my DSPD was diagnosed and I started living on my body's preferred schedule, the depression lifted. My mood is now quite normal, and I have a positive outlook.

Once, when I had to get up very early for an important meeting, I drove to work, and in my sleepy fog, I drove onto a highway using the off ramp. If you've never faced a stream of automobiles coming at you at 60 miles an hour, I don't recommend it. Fortunately, adrenaline kicked in, and I was able to get to the shoulder quickly.

More generally, even getting up a few hours early leaves me somewhat dysfunctional for a day or two and not able to perform well in my work. I've learned to insist on afternoon appointments.

One DSPD patient wrote me saying, "For decades, I worked day jobs after sleeping 3:30-7:30 a.m., catching up on weekends ... That worked while I was young and resilient. Next step was adding a long 'nap' from 5-10 p.m. Wrecks havoc with the social life, but it kept me my job for years. If you can't be normal, you're not good enough. You learn to apologize, make excuses, tell lies. No one understands."

A non-24 patient wrote me saying, "I no longer live in a 24-hour day. I live in a 27-hour day ... I can't predict how much forward I will move, and I can't stop it. There isn't a cure. There are treatments, but their success rate is low, and they have proven unsuccessful for me ... As you can imagine, not having a consistent schedule means that I cannot work a normal job, or any job. No one wants to employ me in the United States. The ADA doesn't help me because they do not consider my disability to be worth accommodating."

Diagnosis

The first hurdle for people suffering from constant tiredness is to get their primary care doctor to refer them to a sleep specialist. Too often the primary doctor treats the problem as insomnia and prescribes sleeping pills or blames it on depression when the real culprit is the underlying circadian disorder. We know of too many people who went for years being repeatedly misdiagnosed and often given medications with side effects for conditions they didn't have.

The sleep specialist often refers the patient to a sleep laboratory for an overnight sleep study. This can diagnose or rule out other disorders such as sleep apnea or restless legs syndrome. Often a multiple sleep latency test (MSLT) is prescribed to check for narcolepsy.

But there is a problem. Most sleep studies are conducted during normal sleep hours. This may not be valid for someone with a circadian rhythm sleep disorder, who sleeps on a different schedule. It is known, for example, that the MSLT can yield false positives for people working the night shift.⁹ Surely the same applies to a DSPD patient working a 9-to-5 day shift.

Scheduling is particularly difficult for non-24 patients, because they often cannot predict where their schedule will be far enough in advance to schedule the study.

Treatment

Treatment attempts to shift the patient's circadian rhythm to fit conventional job schedules. Three treatments are generally suggested: light therapy, light restriction and melatonin. All three may be used together. This assumes normal sleep hygiene is already being followed.

Light therapy involves exposure to bright light. For DSPD and non-24 patients, this would be in the morning; for ASPD patients, it would be at night.

Light restriction for DSPD and non-24 means limiting light exposure to only very dim light in the evening. Light containing a lot of blue should particularly be avoided.

Melatonin, prescribed as a chronobiotic to shift circadian rhythm, should be taken four to eight hours before bedtime. The same dose of melatonin gives rise to widely varying

serum levels,¹⁰ so it is recommended to start with a small dose, perhaps one-quarter milligram, and titrate from there. Too high a dose so long before bedtime may make the patient sleepy. Melatonin has also been prescribed as a hypnotic to help the patient fall asleep more quickly. As a hypnotic, it is taken shortly before bedtime, but that is less effective in shifting the circadian rhythm.

For all three treatments, we suggest initially basing the timing on the patient's current circadian rhythm and gradually shifting the time earlier (for DSPD) or later (for ASPD) until reaching the desired sleep time. Trying to shift the rhythm all at once may result in the opposite effect from that desired – for example, making DSPD sleep time still later based on the phase response curves for light and melatonin.^{11,12}

These treatments, alone or in combination, help some people normalize their sleep and circadian rhythm. For too many others, the treatments are not effective.^{6,13} Forcing the patient to sleep at specified times, when it results in extreme tiredness, continues the deleterious effects of sleep deprivation on the patient's long-term health.

Questionable Treatments

Phase-delay chronotherapy for DSPD – delaying sleep time several hours later each day until arriving at the desired schedule – should no longer be recommended. Effectiveness is short-term at best,⁶ and may lead to non-24, which is far more difficult to live with.^{6,14}

Sleeping pills may put patients to sleep, but they do not shift the circadian rhythm. The sleep may not be restorative, and the other health issues arising from disordered circadian rhythm are likely unresolved.

Causes

Several possible underlying causes of circadian rhythm sleep disorders have been proposed, including a very long circadian rhythm (or short, for ASPD), lack of sensitivity to light, over-sensitivity to light, deficiencies in the intrinsically photosensitive retinal ganglion cells (ipRGCs), lack of melatonin production, long elimination time of melatonin, differences in timing of sleep relative to internal circadian rhythms, etc.¹⁵

It seems likely that different patients may have different underlying causes. DSPD, for example, is a symptom, as fever is a symptom, but it may have different causes in different people. That would explain the low success rates of the various treatments, which are not being tailored to the underlying cause.

Conclusion

Further research is sorely needed. The American Academy of Sleep Medicine (AASM), Sleep Research Society (SRS) and Society for Research on Biological Rhythms (SRBR) are drafting a white paper on needed research, and Circadian Sleep Disorders Network has submitted its priorities.¹⁶ 🌙

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These are examples; many more supporting references are available:

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