

Chapter: 2

Circadian Rhythm Sleep Disorders

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Circadian rhythms continuously drive human functioning round the clock. Daytime alertness, nighttime sleep and daily wake time is controlled by the circadian forces. It is well known that light, hormones, exercise, age, and many other factors influence circadian rhythms.

People from circadian point of view can be divided in to “morning” or “evening” types. They reach their physical and psychological peak in the morning or evening. There is sufficient scientific evidence that hormonal physiology closely follows these behaviors. In addition to an eight hour sleep period, normal sleep patterns include free running. Free running is manifested by falling asleep one hour later than the night before until the cycle repeats. This free running phenomenon is believed to be due to a natural 25 hour cycle. Age is a major factor in manifestation of circadian rhythm. The elderly tend to advance and adolescence delay their rhythmic cycle. There is genetic regulation of circadian rhythms by Crypto chrome (CRY) gene. CRY₁ deficiency sped up the biological clock, while CRY₂ deficiency slowed it down.

Use of a sleep log or diary and Actigraphy is indicated in the assessment of patients with a suspected Circadian rhythm sleep disorders (CRSD). Actigraphy is useful as an outcome measure in evaluating the response to treatment for CRSDs. Polysomnography (PSG) is indicated to rule out another primary sleep disorder in patients with symptoms suggestive of both a CRSD and another primary sleep disorder, but is not routinely indicated for the diagnosis of CRSDs.

Delayed sleep phase disorder (DSPD) causes sleep-onset insomnia. The person is unable to fall asleep until early morning due to desynchronized internal biological clock and the external environment. DSPD generally affects the adolescence and younger adults

A sleep-wake log in DSPD shows a pattern of bedtime later than 2 a.m., few or no awakenings after the sleep onset, shorter sleep periods during the work/school week and long (9-12 hour) sleep time with late morning to mid-afternoon wake up times on the weekend. Polysomnography is not indicated in the routine assessment of DSPD.

Treatment for delayed sleep phase syndrome is aimed at resetting the patient's circadian rhythm and sleep pattern. Although Morning light exposure is indicated in the treatment of DSPD, Optimal timing, duration, and dosing of morning light treatment for DSPD remain to be determined. Chronotherapy is a progressive delay in the schedule of sleep time until the desired sleep schedule is reached may be beneficial for DSPD. Melatonin taken 30 minutes to an hour before bedtime may be helpful in establishing an acceptable pattern. There is insufficient evidence supporting the use of hypnotic medications to promote sleep or the use of stimulant medications to promote alertness for DSPD.

Advanced sleep phase disorder (ASPD) is manifested by major sleep phase advance in relation to the desired clock time, that results in early evening sleepiness, an early sleep onset, and an earlier awakening causing sleep offset insomnia. It is more likely to occur in the elderly. Unlike other sleep maintenance disorders, the early morning awakening occurs after a normal amount of undisturbed sleep. Unlike other causes of excessive sleepiness, daytime school or work activities are not affected by sleepiness. However, the evening activities are cut short by the need to retire much earlier than the social norm.

A sleep-wake log in ASPD typically shows sleep onset times between 6 and 8 p.m. and wake times between 1 and 3 a.m. If chronically forced to stay up later for social or vocational reasons, the early awakening aspect of the syndrome could lead to chronic sleep deprivation and daytime sleepiness or napping. Polysomnography is not routinely indicated for the diagnosis of ASPD

Advanced sleep phase syndrome is treated with Chronotherapy or bright light therapy. The Chronotherapy involves a systematic advancement of bedtime until the desired bedtime is achieved. The bright light therapy would involve light exposure in the early evening inducing a phase delay. Prescribed sleep-wake scheduling, timed light exposure, or timed melatonin administration are indicated as treatments for patients with ASPD

Irregular sleep-wake syndrome (ISWR) involves different and disorganized periods of sleeping and wakeful behavior. Individuals with ISWR may complain of either insomnia or excessive sleepiness. Patients usually have an irregular pattern of at least three sleep episodes during a 24-hour period. The total sleep time in this condition is considered normal for their age. No medical or mental disorder causes the symptoms, and no other sleep disorder is generally present.

The use of sleep-wake logs and/or Actigraphy are indicated to identify and monitor treatment outcomes in ISWR, including in older people with dementia and those living in nursing homes. Daytime bright light exposure may improve circadian rest-activity rhythms and consolidation of sleep and wake. Melatonin is not indicated for the treatment of ISWR in older people with dementia, but may be indicated for children with ISWR and severe psychomotor retardation.

Non-24-hour sleep-wake disorder

Free-running disorder consists of a chronic steady pattern comprised of 1-2 hour daily delays in sleep onset and wake times in an individual living in society. Non 24-hour sleep-wake disorder is rare in the general population. The prevalence in the blind is unknown but about 40% of the blind people tend to report their symptoms occurring in a cyclic pattern. Sleep-wake logs are useful for assessment in FRD patients. Circadian phase markers are useful to determine circadian phase and confirm the diagnosis of FRD in sighted and unsighted patients. Prescribed sleep/wake scheduling as a method to improve circadian rhythms may be useful for therapy of FRD. Timed light exposure and Melatonin administration may be used to treat FRD.

Shift work sleep disorder (SWSD) consists of symptoms of insomnia or excessive sleepiness that occur as transient phenomena in relation to work schedules. The prevalence depends on the shift work in the population. It appears that a majority of individual experience sleep difficulties after a night shift. Between 5 and 8% of the population is exposed to night work on a regular or irregular basis. Both the Morningness-Eveningness Questionnaire (MEQ) and measurement of circadian phase markers like core body temperature nadir or timing of melatonin secretion are of unproved usefulness.

The management of the SWSD includes planned napping before or during the night shift to improve alertness and performance. Timed light exposure in the work environment and light restriction in the morning is indicated to decrease sleepiness and improve alertness during night shift work. Administration of Melatonin prior to daytime sleep is indicated to promote daytime sleep among night shift workers. Hypnotic medications may be used to promote daytime sleep. Modafanil and Caffeine are indicated to enhance alertness during the night shift for SWSD

Time zone change (jet lag) syndrome consists of varying degrees of difficulties in initiating or maintaining sleep, excessive

sleepiness, decrements in daytime alertness and performance, and somatic symptoms (largely related to gastrointestinal function) following rapid travel across multiple time zones.

There is insufficient evidence to recommend the routine use of Actigraphy, polysomnography, or measurement of circadian phase markers in the evaluation of jet lag disorder. When time at destination is expected to be brief (two days or less), keeping home-based sleep hours, rather than adopting destination sleep hours, may reduce sleepiness and jet lag symptoms. The combination of morning exposure to bright light and shifting the sleep schedule one hour earlier each day for three days prior to eastward travel may lessen symptoms of jet lag. Melatonin administered at the appropriate time is indicated to reduce symptoms of jet lag and improve sleep following travel across multiple time zones. Short-term use of a benzodiazepine is indicated for the treatment of jet lag-induced insomnia. Caffeine is indicated as a way to counteract jet lag-induced sleepiness, but may also disrupt nighttime sleep.

In summary, CRSDs are prevalent in the society. They are based on circadian linked changes in various biological functions. Although they are easy to recognize their management can be challenging.

Recommended reading:

1. Carskadon M.A., Wolfson A.R., Acebo C., Adolescent sleep patterns, circadian timing, and sleepiness at a transition to early school days. *Sleep* (1998) 21: pp 871-881.
2. Okawa M., Uchiyama M., Ozaki S., Circadian rhythm sleep disorders in adolescents: clinical trials of combined treatments based on chronobiology. *Psychiatry Clin Neurosci* (1998) 52: pp 483-490.