Jet Lag and Shift Work Disorder

Kathryn J. Reid, PhD[a,*], Sabra M. Abbott, MD, PhD[b]

KEYWORDS

• Irregular schedules • Transmeridian travel • Night work • Jet lag • Shift work • Sleep loss
• Circadian misalignment

KEY POINTS

- Severity of jet lag symptoms depends on direction of travel (east or west) and number of time zones crossed.
- Shift work disorder is characterized by insomnia and/or excessive sleepiness associated with the work schedule and associated with increased risk of obesity, diabetes, hypertension, depression, cognitive impairment, and cancer.
- Treatment of shift work disorder and jet lag disorder aim to realign the endogenous circadian clock with the required work schedule and/or environment.
- Studies are needed to determine the efficacy of treatments for jet lag and shift work disorder currently recommended by the American Academy of Sleep Medicine.
- Development and testing of interventions to improve long-term health outcomes for shift workers are needed.

INTRODUCTION

The circadian system regulates the timing of almost all of our physiologic functions, including blood pressure, core body temperature, hunger, mood, cognitive function, and hormonal profiles of cortisol and melatonin, as well as insulin sensitivity.[1] Circadian rhythms are controlled by a master pacemaker, the suprachiasmatic nucleus, which is located in the anterior hypothalamus.[2] However, we now know that almost all cells of the body have molecular clocks, so that all major organ systems including the heart, lungs, liver, and pancreas have their own distinct circadian timing.[3,4] All of these peripheral systems need to work in synchrony to maintain optimal health.

The circadian clock oscillates with a period that is typically slightly longer than 24 hours in humans.[5] Although circadian rhythms are generated endogenously, they are influenced strongly by the environmental light–dark cycle. In the absence of external time cues, the timing of circadian rhythms, including sleep and wake timing, will drift later each day.[6,7] When the timing of the light–dark cycle is altered as a result of transmeridian travel or shift work, it leads to misalignment of the circadian system with the external physical or work environment. Circadian misalignment has been shown to result in poor sleep and performance and on a more chronic basis is thought to lead to poor health outcomes, including obesity, hypertension, diabetes, and cancer.[8]

The 2 most common causes of circadian disruption in today's modern 24/7 society are jet lag and shift work. Although modern aircraft can travel

The authors have nothing to disclose.

[a] Department of Neurology, Center for Circadian and Sleep Medicine, Feinberg School of Medicine, Northwestern University, 710 North Lakeshore Drive, Room 522, Chicago, IL 60611, USA; [b] Department of Neurology, Center for Circadian and Sleep Medicine, Feinberg School of Medicine, Northwestern University, 710 North Lakeshore Drive, Room 524, Chicago, IL 60611, USA
* Corresponding author.
E-mail address: k-reid@northwestern.edu

Sleep Med Clin 10 (2015) 523–535
http://dx.doi.org/10.1016/j.jsmc.2015.08.006

across multiple time zones in just a few hours, the speed with which our circadian clock adjusts to these changes in the external environment takes much longer. For shift workers, the constant alternation between a conventional sleep–wake schedule and being awake at night and sleeping during the day not only alters the light–dark cycle in relation to the endogenous circadian clock, but also alters feeding patterns. For some people, this mismatch between the endogenous circadian clock and the external environment results in a circadian rhythm sleep–wake disorder that is typically characterized by symptoms of insomnia, excessive sleepiness, fatigue, and physical complaints, such as gastrointestinal disruption, that negatively impact daily functioning. The aim of this article is to describe the criteria for and diagnosis and treatment of 2 circadian rhythm sleep–wake disorders, namely, jet lag disorder and shift work disorder.[9,10]

GENERAL THERAPEUTIC APPROACHES

There are 2 general approaches to address the symptoms of jet lag and shift work disorder. The first is to accelerate realignment of the circadian system with the external environment and the second is to treat the symptoms of insomnia and excessive sleepiness. Multimodal approaches are typically needed and should be tailored to the individual, because the severity of symptoms and timing of treatments depends on the direction of travel and number of times zones crossed or the type of work schedule. For clarity, each disorder is discussed separately.

Phase shifting, or resetting the circadian clock, is achieved by timed light–dark exposure and or melatonin administration. The time of administration of these interventions determines whether they result in a phase delay (later) or phase advance (earlier). Light before the core body temperature minimum (T_{min}) results in a phase delay, whereas light after the T_{min} results in a phase advance.[11,12] The intensity, duration of exposure, and wavelength of light also influence the degree to which the circadian clock will phase shift.[11–16] The response for melatonin is opposite to light, with melatonin before the T_{min} resulting in a phase advance and melatonin after the T_{min} resulting in a phase delay.[17,18] The largest phase advances are achieved with low doses ($\leq$3 mg) of melatonin about 4 hours before habitual dim light melatonin onset, or 6 hours before habitual sleep onset.[19]

Most treatments for jet lag and shift work disorder are derived from small, single-center studies. There is a need for more large-scale, multicenter, placebo-controlled clinical trials to assess not only the efficacy, but also the real-world effectiveness of the currently available treatments, and for the development of improved behavioral and pharmacologic strategies. With this in mind, the therapeutic options described herein are the current standard of care based on the recommendations outlined by the American Academy of Sleep Medicine[20]; further research is still needed.

JET LAG DISORDER

Jet lag disorder results from rapidly crossing at least 2 times zones, with the severity of symptoms typically depending on both the number of times zones crossed and the direction of travel (east or west). Symptoms include insomnia, excessive sleepiness, and decreases in total sleep time.[9,10] There is limited information on the prevalence of jet lag, but given the increasing frequency of international airline travel it is suspected to be quite high.[21,22] Age may predispose people to suffer more symptoms of jet lag. There are various reasons patients seek treatment for jet lag disorder; however, primarily they do so when the symptoms are severe, whether the travel is for recreation or business. A summary of the symptoms, diagnosis, and treatment of jet lag disorder are provided in **Table 1**.

As mentioned, jet lag disorder can be treated by addressing directly the symptoms of insomnia and sleepiness, or by speeding the adjustment, or entrainment of the circadian clock to the new time zone. Although the treatment of symptoms is similar for both eastward and westward travel, approaches that address realigning the circadian system require administration of treatments at different times, depending on the direction of travel.

Practicing good sleep hygiene while traveling is a key approach to improve sleep and speed entrainment to the new environment. Therefore, patients should keep a regular sleep–wake schedule, and sleep in a dark, quiet, and cool environment whenever possible. Other general recommendations that may help to reduce the symptoms of jet lag are to avoid excessive alcohol or caffeine consumption, drink plenty of water to remain hydrated, sleep as much as possible on long flights, and eat meals at appropriate local times once arriving at the new destination. Caffeine and short naps either alone or in combination can be used to improve alertness during the day, but should be avoided close to bedtime.

For travelers who plan to be in the new time for just 1 or 2 days, symptomatic management with short-acting hypnotics (if an adequate sleep opportunity is available) and/or alertness-enhancing