CHRONOBIOLOGY INTERNATIONAL, 18(6), 000–000 (2001)

SLEEP-WAKE SCHEDULE DISORDER DISABILITY: A LIFE-LONG UNTREATABLE PATHOLOGY OF THE CIRCADIAN TIME STRUCTURE

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ABSTRACT

Certain sleep-wake schedule disorders (SWSDs) cannot be successfully managed clinically using conventional methods of sleep therapy. We describe two cases of SWSD, the first following head trauma and the second originating during childhood, that had been misdiagnosed by physicians for many years. After conventional treatment for SWSD with light therapy and melatonin failed to bring about substantial improvement, it was determined that they were suffering from an incurable disability. Hence, we propose new medical terminology for such cases—SWSD disability. SWSD disability is an untreatable pathology of the circadian time structure. Patients suffering from SWSD disability should be encouraged to accept the fact that they suffer from a permanent disability, and that their quality of life can only be improved if they are willing to undergo rehabilitation. It is imperative that physicians recognize the medical condition of SWSD disability in their patients and bring it to the notice of the public institutions responsible for vocational and social rehabilitation. (*Chronobiology International, 18(6), 000–000, 2001*)

Key Words: Circadian rhythm; Head trauma; Light therapy; Melatonin; Rehabilitation; Sleep disorder; Sleep-wake schedule disorder.

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INTRODUCTION

Sleep-wake schedule disorders (SWSDs) are a group of well-established sleep disorders that have been categorized according to patients' subjective reports. The common characteristic of the patients is inability to fall asleep and wake up at desired times. The most prevalent of these is the delayed sleep phase disorder (DSPS); others are non-24h sleep-wake (or free-running) syndrome; ASPS (advanced sleep phase syndrome); and disorganized sleep-wake syndrome (DSWS), also termed irregular sleep-wake pattern, which consists of temporally disorganized and variable episodes of sleeping and waking behavior (1).

Patients suffering from SWSD are treated by one or a combination of several different methods, including chronotherapy (2,3), light therapy (4,5), and vitamin B_{12} (6) or melatonin (7) administration. The term *chronotherapy* in sleep medicine refers to a behavioral technique in which bedtime is systematically delayed, hence following the natural tendency of the human circadian clock to possess an inherited period greater than 24h. Thus, a day longer than 24h is artificially created, until the sleep onset time coincides with the desired sleep time, when the conventional 24h day is reestablished. Thereafter, the patient is instructed to maintain the newly achieved bedtime rigidly and from then not to delay bedtime (8).

Administration of vitamin B_{12} has been reported to normalize human sleep-wake circadian rhythm disorders such as non-24h sleep-wake syndrome, DSPS, and insomnia. However, the mechanisms of the action of vitamin B_{12} on the rhythm disorders are unknown (9). It may act by changing the affinity of the ocular receptors to light or exert a direct influence on melatonin (10). However, there is little experience with this treatment, and very few accounts can be found in the literature.

Light therapy, which became increasingly popular with the recognition of the importance of light in resetting the circadian system, involves using morning bright light exposure to induce a phase advance of both nighttime sleep onset and morning wake-up times. Bright light has been successfully used to realign the circadian phase of shift workers; however, this treatment demands total control of light and dark exposure across the entire 24h day; consequently, it is too complicated to manage (10).

While chronotherapy and light therapy are demanding and difficult treatments that usually lead to compliance problems (and therefore are sparsely reported in the literature), melatonin administration is a relatively simple and easy treatment option. Studies show that melatonin has a sleep-promoting and sleep-entraining action when taken in the evening. The effects of small doses (0.5–5.0 mg) of melatonin follow a phase-response curve that is nearly the opposite of that of light. In day-active persons, phase advances are induced when melatonin is administered in the evening, while phase delays are induced when it is administered in the early morning (11). Melatonin also induces temperature suppression (12), and recent evidence suggests there is a direct relationship between

the ability of melatonin to phase shift the endogenous circadian clock and its temperature-suppressing quality (13). It appears that these characteristics make melatonin an effective means of managing chronobiological disorders such as jetlag (14) and shift-work-induced sleep disorders (15), in addition to sleep disturbances caused by desynchronization of the endogenous sleep-wake cycle from lighting cues in the blind, geriatric, and brain-damaged subjects (16) and circadian rhythm sleep disorders (CRSD), including DSPS (7,17–19).

SWSD are sleep pathologies rarely familiar to doctors. For years, many of our SWSD patients had been incorrectly diagnosed as psychophysiological insomniacs by general practitioners, neurologists, pediatricians, and psychiatrists and therefore were unsuccessfully treated, usually with sleeping pills (20). Despite the existence of several treatments for SWSD, some patients are severely disabled by this condition, and no treatment offers them any relief. What should be the correct medical approach in these cases? We describe two representative cases.

CASE A

A 34-year-old married man with three children was referred to our clinic because of an inability to maintain a regular work schedule thought to be caused by psychophysiological insomnia. The problem had begun 14 years earlier after head injury caused by a car accident during military service. Repeated electroencephalogram (EEG) and computerized tomography (CT) recordings excluded brain damage. Two polysomnographies were done within a 3-year interval. The first one was interpreted as normal sleep, which added objective data to the speculation that the patient was just a malingerer. The second sleep study revealed severe insomnia that was diagnosed as being psychological in origin. Repeated psychiatric treatment and medication over the course of 11 years with tricyclic antidepressants and phenotizines were unsuccessful.

Due to the severity of his condition and on the recommendation of his doctor, the patient consented to a week of hospitalization in a psychiatric establishment for observation. At the end of the observation period, psychiatric pathology was eliminated as the origin of his complaint, and it was concluded he was suffering from an unknown sleep disorder. He was referred to our sleep clinic, where he underwent 2 weeks of continuous wrist actigraphic monitoring while following an unrestricted free-living social routine at home.

The wrist actigraph is a microcomputer that attaches to the nondominant hand; it differentiates between stages of sleep and wake based on the amount of movement of the limb. The data derived by the actigraph give a high level of precision in the evaluation of sleep quality (21). Analysis of the data provided by the actigraph revealed a disorganized sleep-wake schedule (Fig. 1). This was confirmed by a corresponding occurrence of a diurnal peak in melatonin secre-

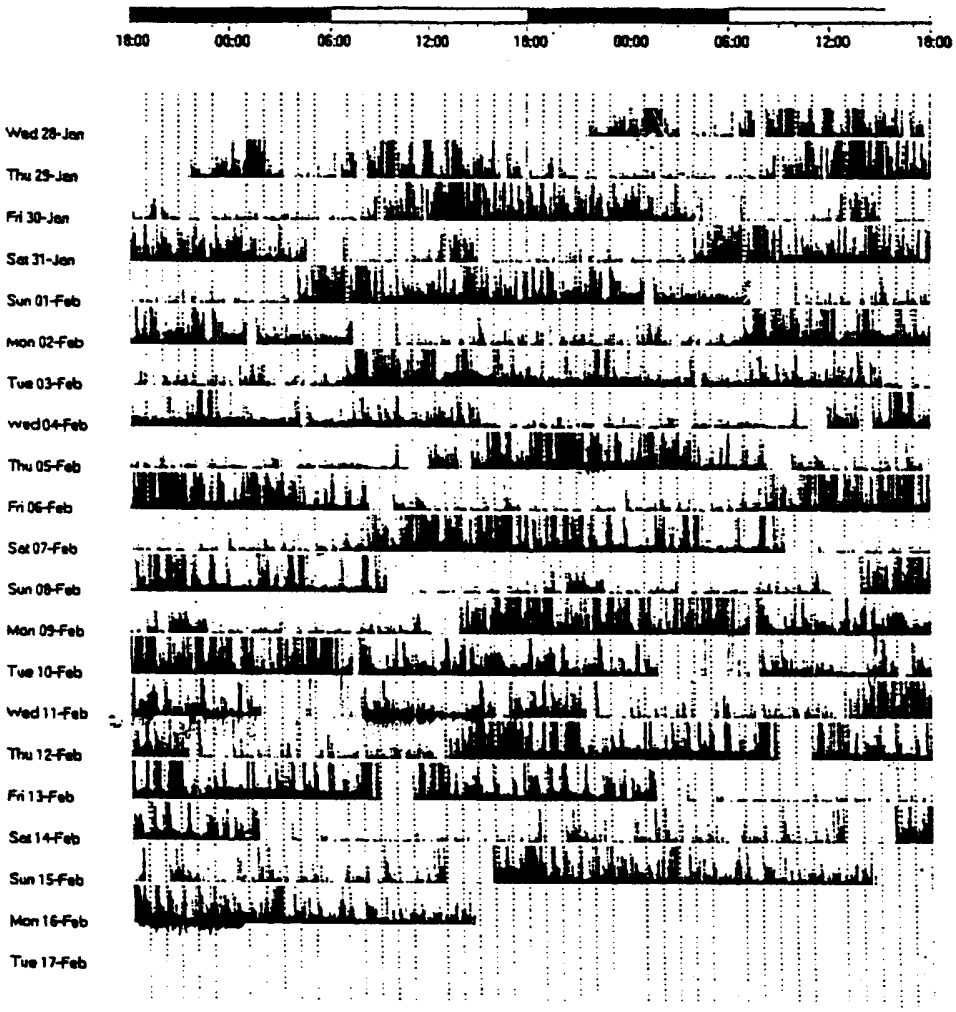

Figure 1. Temporal pattern in activity and rest of case 1 assessed by wrist actigraphy for 20 consecutive days. Each row represents one 24h span. The height of the black marks in the plot indicates the level of activity for any given span of time. Note the patient's activity span often extends into the overnight hours, and that sleep (low activity) often takes place during the daytime.

tion in addition to a nocturnal one. The existence of the disorganized SWSD explains why the results of the two polysomnographies differed so greatly.

The disorganization of the patient's sleep-wake schedule caused him difficulties both at his place of employment, where he was frequently late for work, which was a cause of friction with his superiors, and at home, where his family found him an unreliable participant in scheduled family activities. These current problems plus the stigma of the misdiagnosis of psychiatric instability in a for-

mally healthy and active young man caused him to become increasingly more frustrated and anxious.

The disclosure of a diagnosis that explains the long-standing problems that recurred on a daily basis brought some psychological relief to both the patient and his wife. This motivated the patient to submit to treatment. However, neither bright light treatment (3000 lux) every evening at 20:00 for 3 weeks nor 5 mg of oral melatonin taken at the same hour and for the same period of time brought about any improvement. We came to the conclusion that his disorder could not be treated; consequently, we recommended his circadian rhythm disorder be considered a permanent disability.

Our approach, thereafter, was rehabilitation. Initially, the patient was very discontented with our diagnosis of a permanent disability, and we had to work with him to enable gradual acceptance of the diagnosis. Working together with the patient and the military rehabilitation authorities, a training program was developed to enable him to learn a new occupation. The former patient is now employed as a taxi driver, an occupation that enables him to work within his disorganized sleep-wake schedule. The accurate diagnosis of his medical condition, a persisting circadian pathology of his sleep-wake rhythm, released him from the humiliation of being labeled as abnormal by society and from guilt of his self-perceived "bad behavior" and brought about a profound transformation in the overall well-being of the patient and his family.

CASE B

A 23-year-old man was referred to the sleep clinic by his psychologist. His major complaint was difficulty of falling asleep at night and inability to wake up before noon. The problem began at 12 years of age and caused him severe functional problems. He had changed schools several times when young because his teachers found his being late to school unacceptable. His social life was very limited because it was difficult for him to meet his school friends, who had a different (normal) sleep-wake schedule. During the patient's compulsory service in the Israeli Army, his problems became even more serious, causing him to be jailed three times for being tardy for military activities. The fourth time he was tardy, he was sentenced to jail, where he threatened to commit suicide. He was sent to a psychiatric hospital for evaluation and treatment.

After 2 days of evaluation, he was diagnosed as suffering from simple-type schizophrenia. The diagnosis was based primarily on his long history of social and functional problems and his excessive preoccupation with sleep problems. Treatment with perphenazine induced tardive dyskinesia, a side effect that was successfully treated with propanolol. He was discharged after spending a month in the hospital without improvement of his sleep disorder. He consequently ceased taking the prescribed medication.

A year later, he turned to psychotherapy for help. His psychologist referred

him to our sleep clinic. In the initial clinical interview, the sleep specialist diagnosed DSPS. A 1-week wrist actigraphic monitoring done during an unrestricted free-living routine at home confirmed the diagnosis (Fig. 2) and led us to suspect he was also suffering from an additional sleep disorder. Polysomnography showed periodic limb movement in sleep (PLMS). Treatment with clonazepam improved his PLMS, but not the sleep cycle delay disorder. Several trials with oral melatonin and light therapy also failed to improve his DSPS despite his determination be cured. [F2]

In this case, we again recognized that the patient's DSPS could not be cured by medical treatment, and that he must be made to recognize he was suffering from a permanent disability. Again, the most effective "treatment" was in making the accurate diagnosis of SWSD disability, thereby freeing him from the harsh psychiatric misdiagnosis. It was an arduous chore to convince the authorities responsible for his rehabilitation of the genuineness of his disability. Eventually, with the help of a lawyer, his DSPS was recognized as a disability.

He studied computer programming in rehabilitation and is at last gainfully employed to his satisfaction in a profession that enables him to work at night and sleep during the day. Unfortunately, this does not resolve his social problems.

DISCUSSION

We have presented two cases of SWSD, the first occurring after head trauma and the second originating in childhood. They have three clear common

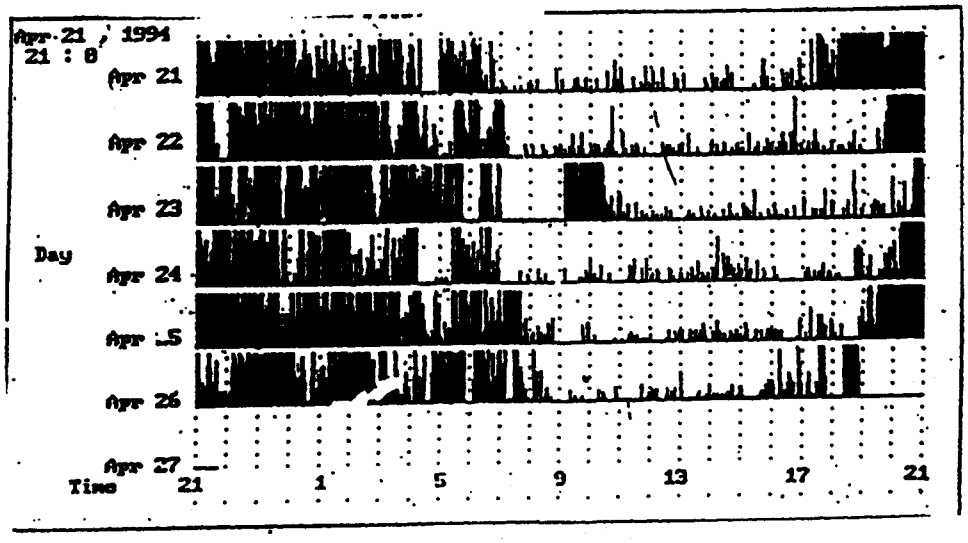

Figure 2. Activity level of case 2 assessed by wrist actigraphy for six consecutive 24h spans. Each row represents one 24h span. Note that sleep onset is delayed, usually commencing around 07:00, or even later some days. The activity span commenced around 17:00 or even later.

denominators: Both patients were misdiagnosed for many years; both cases were unsuccessfully treated medically; last, only after the acceptance of the medical condition as a permanent disability together with a program of rehabilitation was it possible for the patients to cope successfully with life.

These are just two representative cases of the several that have been referred to our clinic and subsequently diagnosed as having a SWSD disability. Many of these patients had been misdiagnosed for many years. Long-term misdiagnosis of SWSD is often due to unawareness of the syndrome by the medical profession (20). We find once the patient is diagnosed with SWSD and after eliminating positive response to conventional treatments, there is no alternative but to draw the conclusion that the patient has a disability and to proceed accordingly. In these cases, we find rehabilitation has a high probability of success, despite difficulties in convincing both civil and military authorities that a discernible disability exists.

In light of the above, we propose new medical terminology to characterize untreatable SWSD as SWSD disability due to permanent pathology of the sleep-wake circadian rhythm. We cannot stress the importance of the accurate diagnosis of SWSD disability to avoid, as much as possible, the long-term distress that maybe harmful and even irreversible in some cases.

When patients complain of sleep difficulties, it is important they are asked clinical questions concerning their sleep-wake habits. If SWSD is suspected, it is advisable to determine when during the 24h the patient feels hunger, is alert, and is sleepy; also, specifics about the sleep-wake routine should be determined. In addition, it is critical to obtain accurate information about functional difficulties experienced in everyday life, plus particulars about sleep habits during vacations. Doctors should also take into consideration prior neurologic trauma, especially head injury, and the possibility of SWSD being a side effect of certain medications. The medical history should probe if the same problems exist in close family members (22). The final diagnosis can be confirmed at a sleep clinic after at least 7 days of 24h continuous wrist actigraphic monitoring done when the patient is free living at home, unrestrained by social routines of others and by work or school schedules.

Once SWSD disability has been confirmed, it is important that the physician council the patient to accept the disability and undergo rehabilitation. It is also essential that the medical profession take the initiative in persuading authorities to recognize SWSD disability as a legal disability. If this is not achieved, there is likelihood these types of patients will suffer long-term significant psychological consequences.

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Received July 7, 2001
Revised July 16, 2001
Accepted August 2, 2001