

The effect of the shift work system on the emergence of sleep disorders

Which challenge for companies?

تأثير نظام العمل بالدوريات في ظهور اضطرابات النوم

أي تحدي للمنظمات ؟

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Abstract: Sleep disorders and biological rhythms well known in shift workers. They are largely due to disorder of the desynchronisation of the biological clock and the effects to a sleep deficit. This article aims to record chronobiological origin of sleep disorders and biological rhythms of night and shift work, using the chronobiological approach to treat this disorder. It addresses the measures adopted by the organizations for in the rehabilitation and the promotion of this category of workers through a multidisciplinary intervention, ergonomy, occupational medicine, occupational psychologist.

Keywords: shift work; sleep, chronobiology; desynchronisation; biological rhythms.

Résumé : Les troubles du sommeil et des rythmes biologiques sont bien connus chez tout les travailleurs postés, ils sont dus en grande partie à un trouble de désynchronisation de l'horloge biologique, et aux effets d'un déficit chronique de sommeil. L'article vise à relever l'origine chronobiologique des troubles de sommeil et des rythmes biologiques de travail de nuit et posté, tout en utilisant une approche chronobiologique permettant de traiter ces troubles. Il aborde les mesures qu'adoptent les entreprises dans la réhabilitation et la promotion de la santé de cette catégorie de travailleurs, par une intervention pluridisciplinaire ; ergonomie, médecine du travail, psychologue du travail.

Mots -clés: travail posté ; sommeil ; chronobiologie ; désynchronisation ; rythmes biologiques.

ملخص: تترتب عن نظام العمل بالدوريات العديد من الآثار على الصحة، حيث تتمثل أساسا في اضطرابات النوم و اضطرابات الوتيرة البيولوجية و التي تعد الأكثر انتشارا لدى فئة العمال العاملين بنظام الدوريات، فهي تتعلق أساسا باضطراب ناتج عن عدم تزامن الوتيرة البيولوجية و إلى آثار النقص المزمن و المتراكم من النوم.

يهدف المقال إلى التطرق للأسباب الكرونوبيولوجية لاضطرابات النوم و اضطرابات الوتيرة البيولوجية، و الناتجة عن نظام العمل بالدوريات، كما يسمح المقال بالتطرق إلى الاستراتيجيات التي يمكن اتخاذها من طرف المنظمات، سواء وقائية أو علاجية و ذلك بتدخل متعدد الاختصاصات، سواء من منظور ارغونومي أو طب العمل أو من قبل المختصين النفسيين.

الكلمات المفتاح : العمل بالدوريات ؛ النوم؛ الكرونوبيولوجيا؛ عدم التزامن ؛ الوتيرة البيولوجية.

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I- Introduction :

Since ever (since the dawn of time), man goes to bed wakes up with the sun, he is in total communion with his biological clock. This internal clock controls the circadian rhythm; it regulates human's activities and synchronizes them with the daily variations of the environment, determined by the rotation of the earth around its axis (Reeth, 2001, p.17).

Artificial daylight lengthening and the appearance of electric light and new technologies have upset the temporal organization of industrial societies. The interest of night and alternating work as well as the need for sleep of the body disrupt people's biological clock.

Sleep work requires the worker to live adept to schedules reversing the usual nycthemere. This inversion and rhythmic disturbances are accompanied by mental and physical health disorders. (benoit, 1984).(leconte,p lambert,c l, 1990).

However, we can say that there is indeed a psychosomatic occupational, professional syndrome linked to the type of work organization that may contribute of the emergence or appearance of the pseudo-nervosas situation (cazamian, 1974).

2. -Issue:

The human organism has a circadian variation characterized by a psychosomatic waking phase during the day, and a phase of deactivation and sleep during the night. (Quennic, 1987). In the case of the day worker, there is phase concordance between the biological activation and the work schedule as well as between deactivation and sleep schedule, in contrast to night work, which has an inverse rhythm. (Leonard,1998,p.85).

Night sleep workers experience a double phase opposition, namely: they have to work in the night deactivation state, hence the obligation to deliver additional or extra efforts for equal tashes .Also, they must sleep in a state of diurnal reactivation, which leads to a poorer quality and more fragmented sleep. This double penalty is at the origin of over fatigue and the diseases relation to it noted in this category of workers.(Leonard, 1998, p.86).

Many studies have shown that the average duration of sleep time decreases. To this loch of sleep, an alteration in sleep composition is added, without forgetting the role played by disturbing noises on daytime sleep, and that (the role) related to the nature of the task assigned (greater difficulty in mental prevalent work, in the night) (leonard,1998p.86).

Il is frequently observed in several studies that the duration of daytime sleep is always 1 to 2 hours less than of night sleep (Guerin et Durmeyer, 1977; Leonard, 1979; Akerstedt et Gilberg, 1991).These workers are in a situation of debt, lack of sleep: they sleep a lot more when they are on vacation or when they have left night are shift work today work, which shows they are not used to getting little sleep.

The various complaints sleep are omnipresent among alternating shift workers whether in (2*8) or in (3*8).

They concern mainly the morning shift which imposes a working time interrupting a sleep that generally didn't start earlier the night before. These complaints are reinforced during shift workers in (3*8), because the night shift, added to the morning shift, obliges them to stay awake at a moment of biological deactivation and sleep at a time of biological activation (Ramaciotti, 2005, p.32).

Quantitatively, the daytime sleep of shift workers alternating at night is shortened from 1 to 4 hours (according to studies) compared to night sleep. This reduction in sleep would appear in stage 2 and the paradoxical phase (RAM sleep) (Walsh et al, 1981; Beugnet Lambert et al, 1988). (Ramaciotti, 2005, p.33).

In the same line of the studies which have studied the issue of shift work and sleep, Lortie (1979) finds days sleep of no more than 2 to 5 hours in permanent night worker. To this first morning sleep, will be added then, an afternoon nap.

In fact, in addition to the reduction of the average sleep time, we can say that daytime sleep is punctuated by frequent awakenings. It is richer in stage 1 and 2, poorer in RAM sleep.

Data on the effect of age on sleep disorders on shift workers are contradictory. In this perspective, (Leonard, 1979) has observed that from 45 years old, the average sleep time decreases frequently, with a slight advantage among women. (Harichaux et Libert, 2005, p.45).

It's true the sleep disorders as found in almost all night and shift workers, but the intensity and number of these disorders vary from one person to another. Hence, the appearance of a syndrome called "clinical intolerance to shift work". This intolerance is not related neither to age, seniority of shift work, type of industry nor to type of rotation. Thus, a 25 year old person / subject became intolerance after one year of shift work, while in the same refinery, a 56 year old shift worker since 30 years, was working without any disorders or medical difficulties.

In addition, the results of a study which includes a population of former shift workers (Butat et al, 1999) allow, enable the study of long-term implication of non standard hours. The results of this study show that the effects of alternating hours on sleep are not only observable during the period when the worker is active but also after he stopped working according to these schedules. Thus, the practice of alternating shift work has probably a long-term influence on sleep (Brugere et al 1996; Marquie et al. 1999) (Ramaciotti, 2005, p.35).

In another study aiming at identifying the role of familial factors on sleep quality and quantity of night workers (Gadbois, 1991), it has been reported a significant reduction of daytime sleep among nurses with toddler.

As for sleep before the morning shift, it is not long enough especially as the sunrise is early and is slashed of a significant fraction of REM sleep, which is plentiful between 5 and 7 am. Johnson (1981) found that it is the night shift that most disturbs the sleep (52%) then the morning shift (36%), which has also been noted by Wedderburn (1978).

2-1-The issue posed:

Thus we can say that there are many questions to ask namely which system has the least negative effects on workers sleep?

3-Some basic facts:

3-1-Chronobiology:

3-1-1Definition of Chronobiology:

Sciences that proposes to study the regular and periodic changes in biological processes at the level of cell, tissue, structure, organism of population (Testu, 2000,p.55).

Knowledge in biology and medicine revolves around 4 questions: where is this happening? An anatomy tries to answer.

How does it work? Understanding of physiological, biochemical and biophysical, mechanisms is required. When? Chronobiology explores variations intima. The question of why, that is, the reasons for the variations are at the centre of research (Marsaudon.2006,p.18).

Chronobiology is the disciplinary which recur or reproduce identical to themselves according to a rhythm defined by a period.

Most of our physiological functions have a frequency of about 24 hours, little variable from one day to another, these are the circadian rhythms.

Chronobiology explores the biological rhythms that have a close relationship with living matter. Chronobiology may be defined as “The scientific discipline which measures explores the mechanisms of biological temporal structures and their relationships in rhythmic manifestations of living matter. There are several rhythms and mainly the most studied are:

a-The circadian rhythms: a period about 24 hours.

b-The ultradian rhythms: a period of a few hours, minutes are scan anyway well under 24 hours.

c-The Infradian rhythms: a period of more than, superior to one day (about 28 days or one year, for example), (Reinberg, 1957,p.22).

3-2Characteristics of biological rhythms:

Reinberg in his book “Des rythmes biologiques à la chronobiologie” “ faon biological rhythms to chronobiology” summarizes their most important aspects. The rhythmic activity, which means the cyclic alternation of hyperactive and hypoactive phases, is a characteristic property of human, plant or animal matter.

3-2-1-

The period of time in time slot “**T**”: flowing between two similar situations (for example 2 maxima and two minima); in other words, the time slot is the time between two consecutive characteristic accidents in the curve of experimental data in accordance of time.

3-2-2

The acrophase “O” also called the peak or zenith of variation which is defined on the time scale relative to an arbitrary landmark such as midnight (24 hours). The acrophase is in the middle of (midnight) reference phase.

3-2-3- The amplitude (A):

It corresponds to half of the total variability of the activity studied.

3-2-4- The mesor (M): or rhythm-adjusted average level: represents the average of the measures for time (t), considered when there measurements are made at equal time intervals (Reinberg et al, 1994.p 31).

Work and Sleep:

Those two words seem at first sight incompatible. Work refers to day, activity, professional and relational spheres, vigilance and alertness, attention. Sleep refers to rest, recovery, personal and private spheres. Yet, work and sleep are intimately linked and interdependent as these two sides of our functioning part of our daily balance.

Shift work or non- standard hours:

* Non-standard working hours:

The term "atypical or non-standard hours applies to all working time arrangements outside of the standard week working day, hours between 1 am and 7 pm, regular working days and hours, no work on public holidays.

The most well known forms of atypical working are night work, weekend work and shift work: (2x8), (3x8), (4x8).

4-factors determining the use of this type of organization

4-1- Technical factors:

They are due to the necessarily continuous nature of certain physical, chemical or operational processes. We can mention the fire industries: steel, chemistry, oil and nuclear power plants.

4-2- Economical factors:

They seem the most decisive today. They have in fact become more and more important in the decisions to in shift work with a night shift. The aim was to maximize the return on investments which has become increasingly cumbersome under the combined influence of accelerated technology innovation obsolescence of machines, reduction of 2 to 3 times the capital to obtain a given production) and the evolution of demand. International competition and the need to maintain employment make constraints more difficult.

4-3- organizational factors:

Continuous work has gradually upstream spread to companies and equipment located or upstream or downstream of the sectors for which they technically justified. This extension of continuous shift work so related to the concentration and automation of production equipment in increasingly large Companies and a just-in-time production.

4-4- Social factors:

Individuals and communities are increasingly demanding continuity of some services, day and night. Examples include: health care, railways, postal and telecommunications services, fire departments, police. We put the primacy of the economic as the purpose of individual conduct and the ultimate criterion of major public decisions. But we must not lose sight that of the fact that the

activities of production, exchange and consumption constitute only the first sphere of human activities.

5-Some sleep data:

Sleep, an essential physiological need, yet still poorly understood, plays a major role both in maintaining same homeostatic functions of the human body (internal temperature regulation, fighting against infections) and to preserve the cognitive integrity of the individual (ability to remember memorize, learn).

Sleep is also one of essential factors in ensuring good daytime alertness. It's also the reflection of psychic life since an individual / a person deprives of REM.

Sleep may develop depressive mood disorders.

According to the American Academy of Sleep Medicine, sleep is defined as follows "Sleep is not a break in the day". It is an important active state to renew our mental and physical health every day. A poor quality or insufficient sleep may cause fatigue, well as concentration and memory disorders as memory disorders, irritability, excessive daytime sleepiness which can have important socio-professional consequences (decrease in professional or academic performance, absenteeism ...), and even dramatic consequences such as accidents at work or on public roads.

6-Physiology of sleep:

The organization of work has an impact on the quality and quantity of sleep. More than 20% of employees are on shift or night shifts, which means / that is 4 to 5 million persons in France. Epidemiological and physiological studies show that this work organization has repercussions on sleep: decreased time and quality of sleep; and also on health: metabolic disorders, cardiovascular, risk of accidents and even breast cancer in Women (Claustrat 2009, p.22).

7-Sleep Disorders in shift workers:

A person is said to be in phase when he lives and works at the moment of best performance, and rests or sleeps in moments of low performance. This notion is of highest interests to understand certain sleep pathologies in shift workers.

Insomnia is a common /frequent occupational health disorder. Its prevalence is around 19% in general population and around 30% among employees. Many studies highlight the serious professional consequences of insomnia: absenteeism, work accidents multiplied by 4.5 in insomniac. Insomnia is a subjective disorder whose consensual definition refers to the classifications DSM N and ICS D-2.

Many studies show the effects of team work (mainly night shift) sleep (Best 1/200. 2000). Most of these studies show that sleep is the first human function to be disturbed by atypical / unusual hours, which is due to the fact that the sleep-wake rhythm is disturbed (Ramaciatti, Zimmermann, Blaise, Zoganas," & Ganik, 1987) even conclude that sleep disorders are the only symptoms attributable (specifically) to night shift whereas the other harms / disorders, described below, are related to the overall penalty associated to work usually performed at night.

8-Effects on health:

Diseases related to night work and atypical unusual working hours:

- Sleep Disorders aggravated by a noisy environment, shift start at variable hours; taking sleeping pills with a risk of drowsiness higher because of the monotonous job to do (screen monitoring).
- Irritability, stress, chronic fatigue (sleep deprivation, long commute home workplace, anxiety, depression that may require taking antidepressant medicines.

To fight against drowsiness and stress, risk excessive consumption of tobacco, coffee, food favouring the appearance of ponderal excess, taking alcohol, drug.

-Digestive disorders.

-Cardiovascular disorders.

- Decrease of intellectual performance, awareness.
 - Disruption of social and family life, unable to attend certain family events, associative activities, practice sports
 - Sense / feeling of isolation, to be behind in terms of corporate life..
 - Sense / feeling of isolation, to be behind in terms of social and family life.
 - Abnormalities of biological parameters: melatonin, cortisol (hydrocortisone), cholesterol, prolactin, testosterone.
 - Circadian rhythm Disruption (sleep-wake cycle).
- Early psychophysiological depressive syndrome. wear.
- Depressive syndrome

9-Experts recommendations on shift and night work for shift and/ or night workers.

On the light of this scientific information, it is difficult to determine a type of working organization that may satisfy and optimally respond to the biological and physiological characteristics of the human being.

But it is important to take into consideration the following recommendations:

- Informed the employees about the medical risks linked to shift work, give them at least once a booklet containing information about these risks, concerning breast cancer, to facilitate the referral of employees to the screening and management network; offer to the employees the possibility to benefit from medical surveillance of night and day workers, even after they change jobs or retirement; establish a medical surveillance register for night shift workers.
- Ensure that the work environment is designed: light, noise temperature, and next room, involve nurses in monitoring shift workers under the responsibility of occupational physicians.
- Provide sleep training for workers, biological rhythms, medical risks of these type of organization means of prevention. (Claustrat 2009.P.28).

10- conclusion:

Working at night or on rotating has advantage /benefits, mainly in terms of the company's competitiveness but also major challenge the most important of which is managing sleep deprivation and ensure better work awareness. It is important to take into account chronobiological data for a better adaptation. This is a shared responsibility between managers and employers.

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