Increased awareness of the role of sleepiness as a contributing or causative factor in workplace accidents and driving fatalities has resulted in a new role for sleep specialists. Some regulatory agencies including the Federal Aviation Association (FAA), and the Federal Motor Carriers Safety Association (FMCSA), have looked to the sleep specialist to evaluate the safety of returning an individual to their workplace after the transportation employee has been diagnosed and treated for sleep disorders. This has placed an incredible responsibility on the sleep specialist. While the sleep specialist may not want to embrace this responsibility, it is clearly within the realm of sleep medicine and there is no other group of professionals better equipped to make such decisions. The American Academy of Sleep Medicine (AASM) recognizes this role for sleep specialist and has stated in its Practice Parameters that “the sleep clinician is responsible for assessing response to treatment, and making clinical decisions that affect individual and public safety.”

To aid the sleep clinician in the decision process, there are both objective and subjective measures available. However, given the implications of releasing an individual to return to an occupation with a high safety risk, the focus has been on objective testing rather than just subjective reports which are prone to bias and manipulation. The two objective tests available for evaluation of sleepiness and alertness are the Multiple Sleep Latency Test (MSLT) and the Maintenance of Wakefulness Test (MWT), respectively. They have been used for decades in the evaluation of medications, diagnosis of sleep disorders, and in evaluation of response to treatment for patients with sleep disorders. In response to the increasing awareness of the dangers of impaired alertness on personal and public safety in the workplace especially in high risk occupations, the use of these tests has expanded to include the assessment of workplace safety. In particular, the MWT has become the de facto gold standard with demonstrated validity. Its validity is based on numerous studies that show decreased latencies following sleep deprivation, sleep fragmentation, and use of hypnotic medications. In addition, increased latencies have been demonstrated following extended sleep and the use of stimulant medication. The MSLT has also been shown to have a high test-retest reliability of 0.97 in normal subjects which is not affected by test intervals or level of sleepiness. Based on these and numerous other studies, the Practice Parameters state that “the MSLT is a validated objective measure of the ability to stay awake.”

The Practice Parameters also recommends that the MSLT be used to measure sleepiness and diagnose narcolepsy. If a worker is being evaluated for narcolepsy then this is an essential and appropriate test. However, there are a number of problems that have become apparent when the MSLT is used in other situations. When the MSLT was used in treated sleep patients, the changes in sleep latency were not as great as would be expected based on clinical reports of improvement following treatment. It was suggested that this is because the MSLT asks the patient to try to fall asleep, so it is not an appropriate measure of an individual’s ability to stay awake. Additionally, it has recently been shown that MSLT results can be manipulated by individuals to show longer latencies for monetary gain. This makes the MSLT a less appropriate and reliable measure for evaluating an individual’s ability to stay awake.

By contrast, the MWT requires the individual to stay awake for as long as possible, so using the MWT rather than MSLT makes intuitive sense if one is interested in the ability to stay awake. The validity of the MWT is inferred from the various studies that show an increase in MWT latency following stimulant medication and a decrease in the latency following sleep deprivation. This has led to the Practice Parameter that “the MWT is a validated objective measure of the ability to stay awake for a defined time.” Additionally, Bonnet & Arand have demonstrated that the MWT latency cannot be manipulated by the individual to produce longer latencies. In that study, normal individuals could not increase their latencies on the MWT even when offered financial incentive to do so, unlike the MSLT. The difference between MWT and MSLT findings is not surprising since there is a low correlation between MSLT and MWT latencies indicating...
that they measure different abilities and therefore findings from one are not necessarily applicable to the other. In any case, these studies support the MWT as a valid and stable measure of alertness that is especially suited to the evaluation of workplace safety where monetary motivation would be expected, yet it could not produce more favorable results on the MWT.

**MWT Normative Data**

Another very important aspect of the MWT is the fact that normative data is available. This normative data comes from one large study of normal subjects using the 40-minute MWT. Since the data is from a single study, concerns about variability due to variation in protocols, subject selection or scoring criteria are not applicable. The availability of this normative data provides a comparison for the latency data obtained from the MWT. The various cutoff values available from this data provide the clinician with valuable information to use in clinical decisions about an individual’s alertness.

The mean, median, mode, and range of normal values provide the most obvious cut points, although median data have not been published for the MWT. On the 40-minute MWT, the mean is 30 minutes with a standard deviation of 11.2 minutes. This makes the “normal” range 8-40 minutes. While this range is large, it is important to note that 42% of the normal controls have a mean latency of 40 minutes (mode), meaning that they did not fall asleep on any trial. From a clinical perspective, a patient with a 40-minute latency would be “normal” and likely be judged to be able to return to the workplace without posing a safety concern related to alertness. In contrast, if a patient had a mean sleep latency < 8 minutes, it would likely be concluded that the patient’s alertness was not “normal.” In this case, further intervention would likely be needed before releasing the individual for work. Therefore from a clinical perspective, the MWT distinguishes those who have a maximal level of alertness and those who do not have a normal level of alertness. These values would include almost half of the population.

Clinical decisions are more difficult when individuals have latencies between 8 and 40 minutes on the MWT. While these individuals statistically fall within a normal range, they may be above or below the average. This information alone can be very useful to the clinician when integrated with the clinical history as recommended by the standards of practice. If a patient reports no difficulty staying awake while driving or in sedentary situations, latency in the normal range may provide adequate confidence to release an individual for return to the work place. However, this decision may be impacted by the type of occupation and its relationship to public safety. For low risk occupations, being within the normal range maybe adequate even if it is below the average. As job risk increases, longer latencies maybe reasonably expected. In dangerous and high-risk situations the clinician may want evidence of the longest sustained alertness. Certainly below average alertness should have some implications for high-risk occupations and this may overshadow a latency just being in the “normal” range. Thus in this range of latency scores, a simple comparison to normal values is not particularly useful, unless it is evaluated within the context of the patient’s history, occupation risk and other available information. In this larger context, the MWT data is very useful.

In addition to statistical cut points, the normative data from the MWT also provides a needed yardstick to measure and compare alertness levels for MWT latencies from all individuals evaluated for workplace safety whether or not they have a diagnosed sleep disorder. Differences between groups of normal controls and individuals with sleep disorders are irrelevant if the goal is to evaluate alertness level. If some “normal” controls have short latency scores, it is because they have some impairment in alertness also. This is not surprising since chronic partial sleep deprivation is pervasive in our society. Individual latency comparisons with the current normative data provide a reasonable barometer of alertness for all individuals.

Apart from any comparison to normal data, the MWT can be used to monitor changes in alertness overtime. Changes in treatment strategies or increased concerns about an individual’s alertness can be monitored using the MWT. Since clinicians cannot always anticipate the need for such assessment, obtaining MWT data on individuals being evaluated for workplace safety may also have future use and benefits not currently perceived.

**The MWT in Context**

The latency data from the MWT is not intended to be used or interpreted in isolation. It is a clearly stated standard of practice that “the MWT is used in association with the clinical history to assess the ability to maintain wakefulness.” (page 115) Factors such as total sleep time, sleep schedules, medications, alcohol use and medical problems all play a role in affecting an individual’s level of alertness. If the patient’s history indicates that these are reasonable or adequately controlled and the patient reports that he does not have difficulty staying awake during the day, then this can add confidence when interpreting MWT data. In contrast, if the patient reports still falling asleep during the day or while driving, such reports would likely over shadow the results of any test for alertness.

Like most medical tests, the results of the MWT are not meant to be the sole criteria for making a clinical decision. Certainly having objective data concerning an individual’s alertness seems not only reasonable but essential for assessing an individual in whom there are concerns about their safety in the workplace relative to alertness. However, the MWT data provides only one piece of information concerning an individual’s level of alertness. It is the clinician’s role to put this information into perspective when making decisions concerning the patient.

**The MWT and Safety**

An important rationale for using the MWT in the evaluation of workplace safety is that there is a relationship between MWT latency and safety. Previously there was not a lot of data to support such a relationship. However, the lack of data is not the same as showing there is no relationship. Intuitively, such a relationship would be expected. This reasonable expectation was reflected in the consensus statement from the AASM practice parameters that “the MWT 40-min protocol may be used to assess an individual’s ability to remain awake when his or her inability to remain awake constitutes a public or personal safety issue.” (p117) At that time, there was not a lot of evidence to support it however, new studies have emerged demonstrating that there is a relationship between MWT values and safety.

Recent studies have shown that there is in fact a strong and predictive relationship between MWT latencies and safety. A study of
actual driving performance in professional bus drivers showed increased MWT latencies and improved actual driving performance following CPAP treatment. Another study showed shorter MWT latencies in drivers who had actual car crashes compared to control subjects. These studies are important since they compared actual driving performance with MWT latencies. A more recent study of simulated driving performance following sleep deprivation with and without alcohol showed a significant correlation with MWT latency and performance. More important was the finding that the MWT latency was reasonably predictive of driving performance in normal subjects. The authors noted that the “correlation between MWT latencies and reaction time supports the validity of the MWT as an indicator of driving safety.” These new studies are extremely relevant because they include real-life performance data and they provide the strongest evidence yet that the MWT is an indicator and predictor of safety.

Evaluating the Cost

The relationship between alertness and workplace safety is not in dispute but there is disagreement about whether or not sleep clinicians should take an active role in this area at the present time. The choices can be evaluated in terms of their associated costs. There is the cost of doing nothing and just waiting. This has brought us in part, disasters such as 3 Mile Island, Challenger, and the Exxon Valdez. Decreased alertness continues to cause errors and accidents in intensive care units, industrial workplaces, and roadways. Such mistakes cost millions of dollars as well as innocent lives. In comparison, there are also costs associated with accepting the responsibility now and acting within our current knowledge base to improve public and workplace safety. The cost of evaluation and an MWT are maximally a couple thousand dollars and any inconvenience to the patient is minimal. The more important cost is in the potential for an individual to lose his or her job. Ideally, intervention would be available to enable an individual to function at an alertness level commiserate with the occupation to help insure the safety of others. In other cases, options such as changing occupations may need to be considered. In some cases alternatives may not be readily available, and concern for public safety and workplace safety may outweigh concerns that the jobs of some individuals would be negatively impacted. Given the two options and the comparative costs, the decision is simple. The cost of doing nothing is too high.

Job Requirements and the MWT

Setting job requirements and requiring a certain set of skills or abilities for a particular position is not new. What is new is considering the ability to remain alert as a requirement in high-risk occupations. While this may seem farfetched, it is already occurring. The United States Air Force has recognized the value of the MWT and has recommended the MWT in the evaluation of alertness in pilots with hypersomnia. Australia has recommended the MWT along with other tests to assess fitness for driving in individuals with sleep disorders who present a safety risk because they may fall asleep while driving. Clearly, there is growing acceptance of the MWT in the evaluation of workplace and driving safety. More research is needed concerning the MWT and development of other tests to be used in the evaluation of safety. There is certainly a need for testing that can be done quickly and simply in the field. However, we must start somewhere in our efforts to evaluate individuals for workplace safety. The MWT provides the best available measure of alertness. Consequently, based on the data now available it is reasonable and appropriate to use the MWT in the evaluation of workplace, occupational, or driving safety.

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