

# The Danger Zone: Micro Sleep Episodes Prior To Sleep Onset In Maintenance Of Wakefulness Tests

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## Introduction

- Sleep onset is currently defined by the first appearance of at least 16 seconds of any sleep stage in a 30-second epoch of recording. Shorter segments of sleep (micro sleep) prior to sleep onset are ignored in objective assessments of daytime sleepiness such as the Maintenance of Wakefulness Tests (MWT).
- The Odds Ratio Product (ORP) [1] is a new continuous index of sleep depth calculated in 3-sec epochs from the electroencephalogram. ORP values range from 0-2.5 with a value of 1.5 seen as cutoff between wake and sleep.
- We wanted to characterize the instability of alertness during the sleep onset process in MWT and identify microsleep episodes prior to R&K [2] derived sleep onset using the 3-sec ORP.

## Methods

- The Polysomnograms from 8 subjects with EDS who previously underwent MWTs [3] were re-scored for 3-sec ORP using the Michele Scoring system [4].
- Each subject had 4 nap opportunities separated by 2-hour intervals.
- Sleep onset latencies (SOLs) were determined by both R&K criteria and ORP criteria. ORP values were calculated in 3-second epochs from the electroencephalogram (C3/A2 and C4/A1).
- An episode of micro sleep was defined as a 3-sec ORP value  $\leq 1.5$ . Sleep onset per ORP criteria was defined as the onset of at least 1 micro sleep episode with a 3-sec ORP value  $< 1$  or 2 episodes occurring within 9 seconds with ORP values  $\leq 1.5$ .

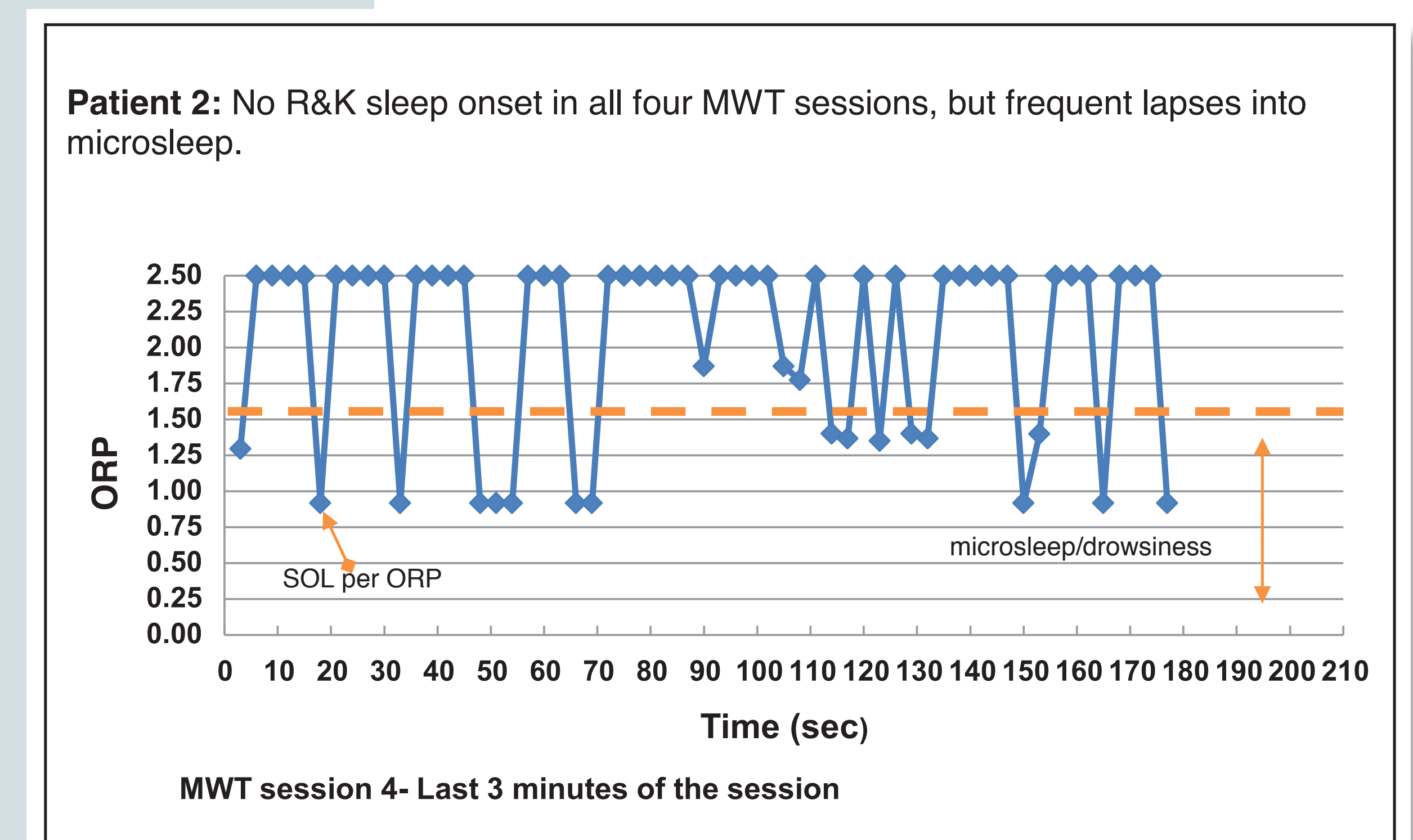
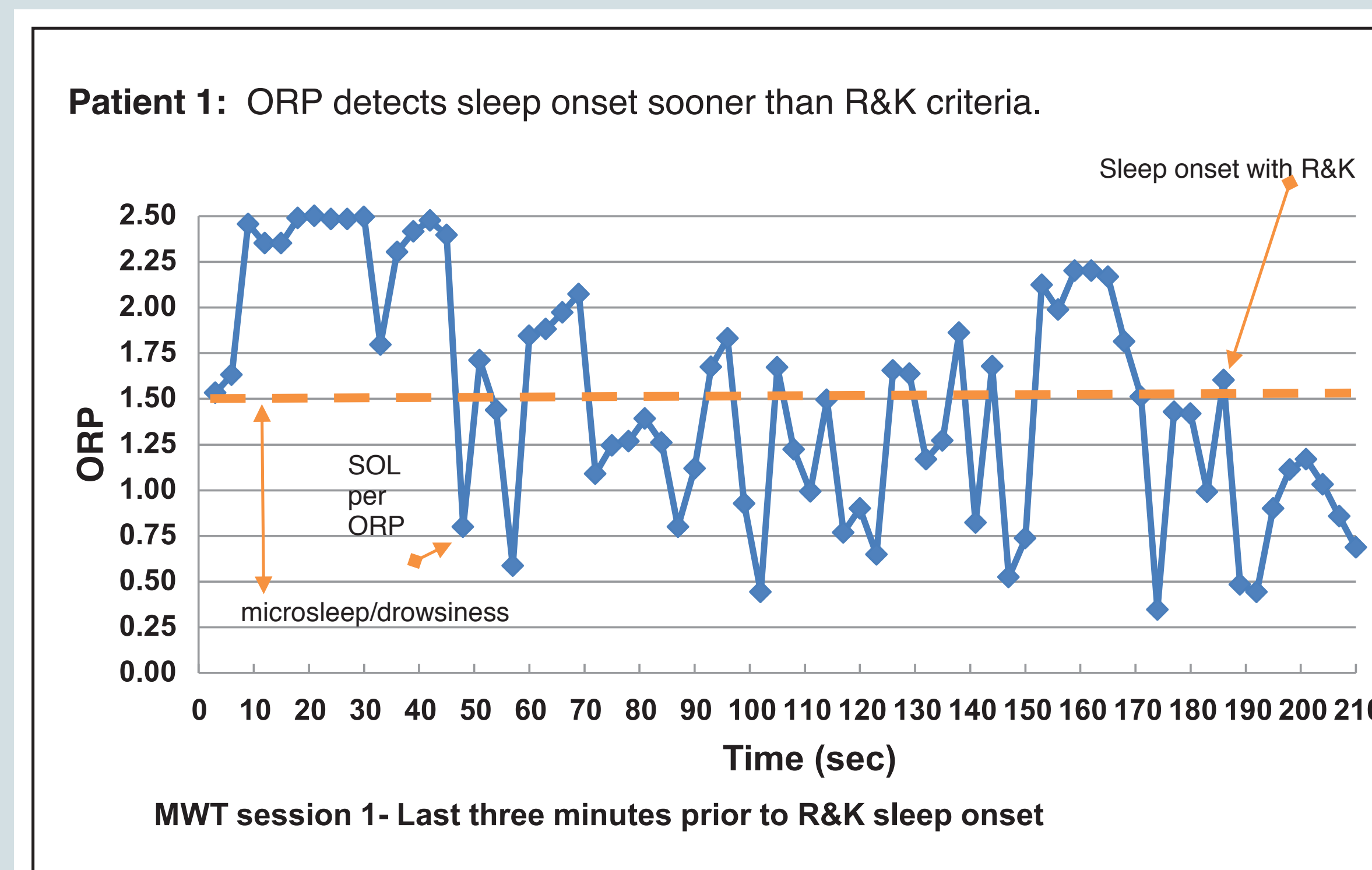
## Results

- The average number of lapses into microsleep episodes per minute prior to R&K sleep onset was  $1.69 \pm 1.51$  (Table 1).
- Mean SOLs for the 8 MWTs using ORP criteria were on average shorter than those determined by R&K by 6.15 minutes (0.35 - 20.75).
- Six individual MWT nap opportunities and 2 full MWTs showed normal sleep latencies per R&K criteria despite frequent lapses in alertness as suggested by ORP scores (Figure 1).

Table 1. Microsleep and sleep onset in normals and patients with EDS in the MWT using R&K and ORP criteria

Patient ID	Patient DX	Mean SOL per R&K (min)	Mean SOL per ORP criteria (min)	SOL difference (min)	Total microsleep episodes before R&K sleep onset*	Microsleep episodes/min prior to R&K sleep onset
1	OSA	8.75	6.72	-2.03	60	1.7
2	OSA	29.45	6.19	-23.26	415	3.5
3	OSA	2.38	2.01	-0.30	15	1.5
4	Narcolepsy	8.38	2.26	-6.11	146	4.4
5	Narcolepsy	3.88	2.18	-1.70	7	0.5
6	Narcolepsy	4.75	2.64	-2.11	24	1.3
7	Sleep deprived normal	10.75	5.81	-4.94	18	0.4
8	Sleep deprived normal	17.38	8.66	-8.71	15	0.2
Mean $\pm$ SD				6.15 $\pm$ 7.45 $t = -2.334, P = 0.026$ (one tailed)		1.69 $\pm$ 1.51

Figure 1. Examples of microsleep and sleep onset in MWT using R&K criteria vs ORP



## Conclusion

ORP scoring demonstrates fluctuating alertness levels with frequent microsleep episodes prior to R&K defined sleep onset and may provide a more accurate assessment of potentially dangerous alertness lapses.

## References

- [1] Younes M, et al. Odds ratio product of sleep EEG as a continuous measure of sleep state. *Sleep* 2015;38(4):641-654.
- [2] Rechtschaffen A, Kales A. A manual of standardized terminology, techniques and scoring system for sleep stages of human subjects. U.S. Government Printing Office, National Institute of Health Publication: Washington, D.C. No.204; 1968.
- [3] Mitler MM, et al. Multiple daytime nap approaches to evaluating the sleepy patient. *Sleep* 1982;5 Suppl 2:S119-27.
- [4] Malhotra A, Younes M, Kuna ST, Benca R, Kushida CA, Walsh J, Hanlon A, Staley B, Pack AI, Pien GW. Performance of an automated polysomnography scoring system versus computer-assisted manual scoring. *Sleep* 2013;36:573-582.