

# **The utility of respiratory inductance plethysmography in REM sleep scoring. An application on multiple sleep latency test.**

*Panagis Drakatos<sup>1</sup>, Sean Higgins<sup>1</sup>, Ian Duncan<sup>1</sup>, Kate Brindle<sup>1</sup>, Sam Briscoe<sup>1</sup>, Brian Kent<sup>1</sup>,  
Guy Leschziner<sup>1,2</sup>, Adrian J Williams<sup>1,2</sup>.*

<sup>1</sup>: *Guy's and St Thomas' NHS Foundation Trust*

<sup>2</sup>: *King's College London*

**Objective:** Rapid eye movement sleep (REM) is characterised by a characteristic erratic breathing pattern, which is not included in the current scoring recommendations. We investigated the feasibility of using respiration, derived from respiratory inductance plethysmography (RIP), to facilitate the identification of REM sleep.

**Patients and Methods:** The modified nocturnal polysomnography (NPSG) of 20 consecutive patients, was scored by five experienced sleep scorers, blinded to the final diagnosis, using only chin electromyography, electrocardiography, pulse oxymetry and RIP for the detection of REM (RespREM), with subsequent assessment of accuracy against the current AASM guidelines for scoring REM, and intraclass correlation coefficient to assess reproducibility of measurement between different scorers. In 41 consecutive MSLTs with sleep onset REM periods (SOREMPs) and RIP signal available, RespREM was sought by one scorer and time difference with the current guidelines was analysed taking into consideration the sleep stage sequence of SOREMPs.

**Results:** The Cohen's weighted kappa for the presence of REM and its duration in NPSG, using RespREM and compared to the current guidelines, ranged between 0.89 to 0.93 and 0.68 to 0.73 respectively for the 5 scorers. The respective intraclass correlation coefficients were 0.89 (0.82 to 0.94, 95% CI) and 0.95 (0.90 to 0.97, 95% CI). In 97.7% of the SOREMPs during MSLTs the RespREM was present and in almost half of the SOREMPs (46.6%) it coincided with the REM

onset, while in the majority of the remainder (91.5%) RespREM preceded conventional REM onset, especially when a sleep stage 1-REM transition was present (72.1%).

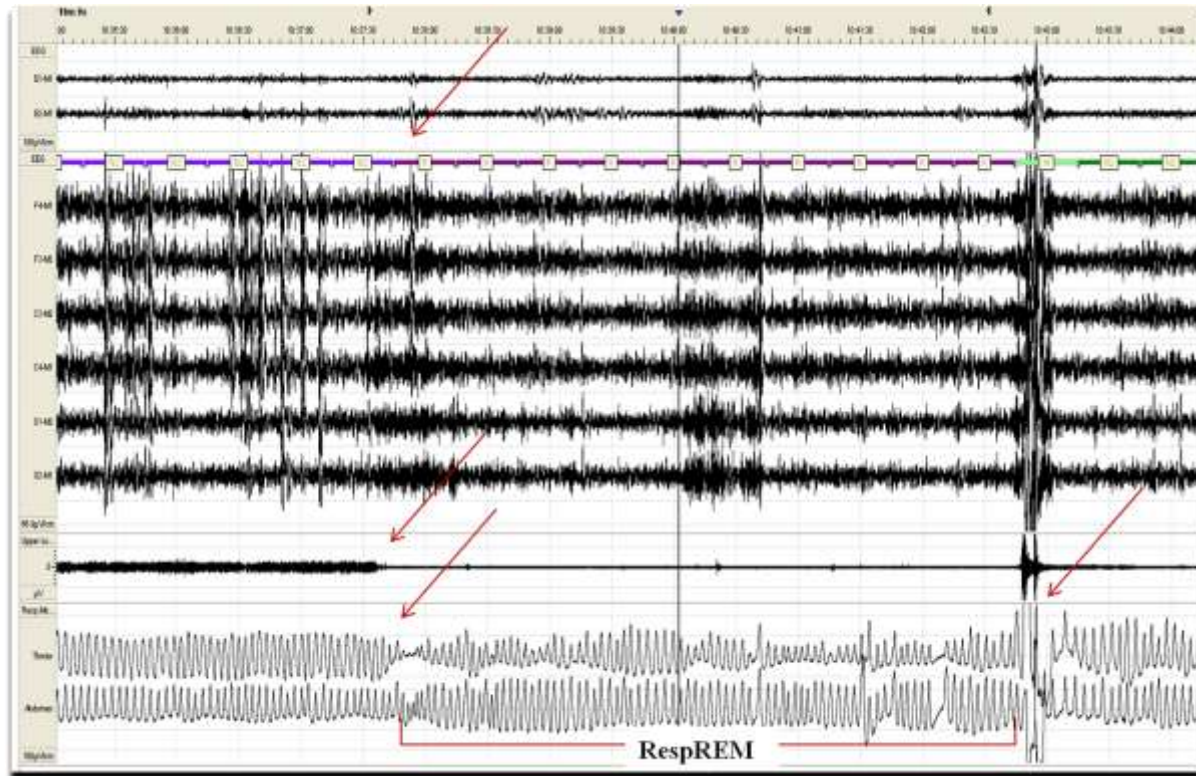
**Conclusion:** The erratic breathing pattern during REM, derived from RIP, is present and easily recognisable during SOREMPs in the MSLTs. If validated in larger, prospective cohorts, this may serve as a useful adjunctive measure in identifying REM sleep.

Table 1. Agreement between AASM guidelines and RespREM rule in scoring REM periods (presence and duration) in NPSGs. Time difference of REM onset between the two methods is also reported.

	<b>NPSG (98 REM periods)</b>
<b>Presence of REM periods</b>	
Scorer 1	0.93 (0.87 to 0.98)
Scorer 2	0.74 (0.61 to 0.86)
Scorer 3	0.79 (0.66 to 0.91)
Scorer 4	0.76 (0.60 to 0.91)
Scorer 5	0.89 (0.80 to 0.99)
ICC	0.89 (0.82 to 0.94)
<b>REM duration</b>	
Scorer 1	0.69 (0.51 to 0.86)
Scorer 2	0.68 (0.52 to 0.84)
Scorer 3	0.73 (0.61 to 0.86)
Scorer 4	0.70 (0.54 to 0.85)
Scorer 5	0.73 (0.53 to 0.84)
ICC	0.95 (0.90 to 0.97)
<b>Time difference in REM onset*#</b>	
Scorer 1	2.30±0.01
Scorer 2	2.16±0.01
Scorer 3	2.16±0.01
Scorer 4	2.10±0.01
Scorer 5	2.59±0.03

Data are presented as Cohen's weighted kappa (95% confidence interval). \* Data are presented with mean±SD. #: p>0.05 (Anova). ICC: intraclass correlation coefficient.

Figure 1. Erratic breathing during REM (RespREM), as identified from respiratory inductance plethysomgraphy. Transition from NREM2 to REM.



The upper arrow indicates the first REM epoch, the middle arrow the drop in chin EMG and the lower two the RespREM.