MAXILLO-MANDIBULAR DISTANCE AS A MARKER OF EFFORT IN NON APNEIC SLEEP-DISORDERED BREATHING*

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INTRODUCTION: Certain sleep disordered breathing events are not revealed by direct evaluation of naso-oral or thoraco-abdominal activity. This is the case in heavy snoring, Respiratory Effort-Related Arousal (RERA) and Upper Airway Resistance Syndrome (UARS). In order to quantify these events it is necessary to measure breathing efforts during sleep. Sophisticated analyses of nasal pressure curves, thoraco-abdominal movements and central nervous system (CNS) arousals have been proposed as surrogates for oesophageal pressure (Poes) measurement. We hypothesized that the recording of mandibular movement during sleep was a good surrogate for oesophageal pressure in the diagnosis of non apneic sleep-disordered breathing.

AIMS: Previously we observed that breathing efforts during sleep were accompanied by:

1. Oscillations of the mandible at a frequency in the range of the respiratory frequency (0.15 – 0.30 Hz);
2. Lowering of the mandible greater than 20% of maximal voluntary opening of the mouth.

These features of mandibular activity allowed us to detect efforts associated with apneas and hypopneas. The present study was conducted to define the pattern of mandibular movements associated with UARS.

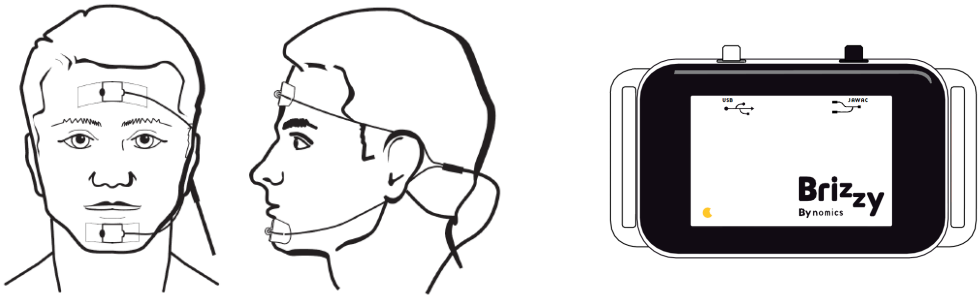

Figure 1:
LEFT - Sensor placement for measurement of mandibular movements.
RIGHT - BriZzy device for recording of mandible movements during sleep.

METHODS: Fifteen UARS patients, 9 women and 6 men (mean age: 42-year-old ± 16.5 SD), entered the study. The UARS diagnosis was based on the history (chronic fatigue, excessive daytime sleepiness) and polysomnography (PSG). An Upper Airway Resistance Event (UARE) was marked on the PSG recording when:

a) a progressive Poes inspiratory decrement below –15 cmH2O occurred;
b) ended by an abrupt increase of Poes associated with a CNS arousal;
c) without any feature of apnea or hypopnea (Figure 2).

UARS was confirmed when:

a) the AHI was lower than 10/h;
b) the Arousal-RDI index was higher than 20/h.

A maxillo-mandibular distance recording was obtained by using 2 coupled small magnetometers attached, one on the chin and the other on the forehead, on the vertical midline of the face (Figure 1). The signal was integrated in a complete PSG, along with the Poes, and recorded under the name Jawac (for Jaw Activity).

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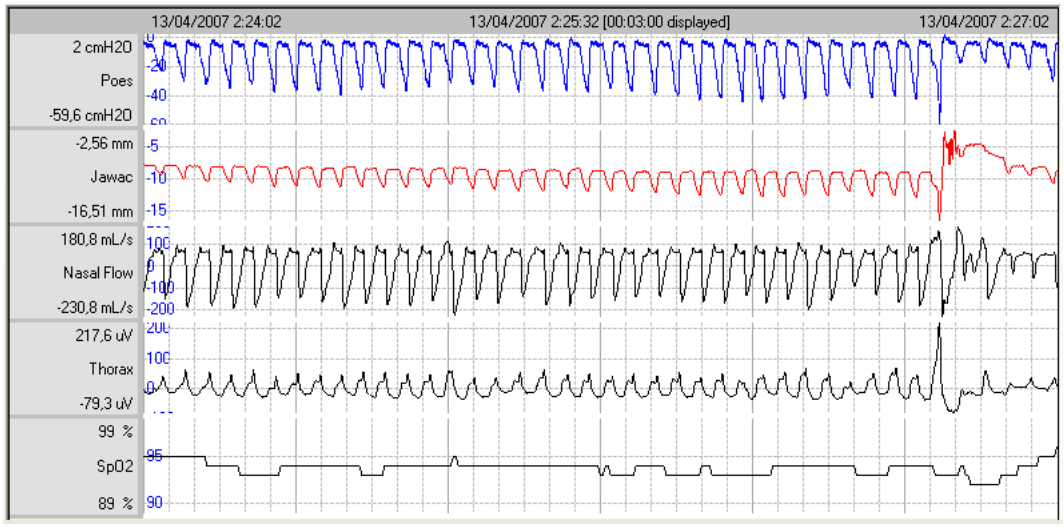

Figure 2: Extract of a PSG recording during an Upper Airway Resistance Event (UARE).
Poes is oesophageal pressure, Jawac is mandible position, Nasal Flow is airflow measured through a nasal cannula, Thorax is thoracic motion, and SpO2 is oxygen saturation.

RESULTS: On tracings of the maxillo-mandibular distance (Jawac signal), UARE was indexed by progressive lowering of the mandible with continuous inspiratory (oscillatory) superposed movements. The lowering ended by an abrupt elevation, coincident with an arousal. The behavior of the mandible associated with UAREs differed from the one associated with apneic events:

1. by a linear evolution of the mandibular lowering (vs non linear in apneic events);
2. by a longer duration (216 ± 166 vs 18 ± 10.5 s, p <0.01) (Figure 3 – LEFT);
3. by a more abrupt elevation of the mandible ending the progressive lowering; and
4. by fewer breathing cycles following the termination of the respiratory event (1.2 ± 0.5 vs 7.4 ± 3.1 breaths, p<0.01) (Figure 3 – RIGHT).

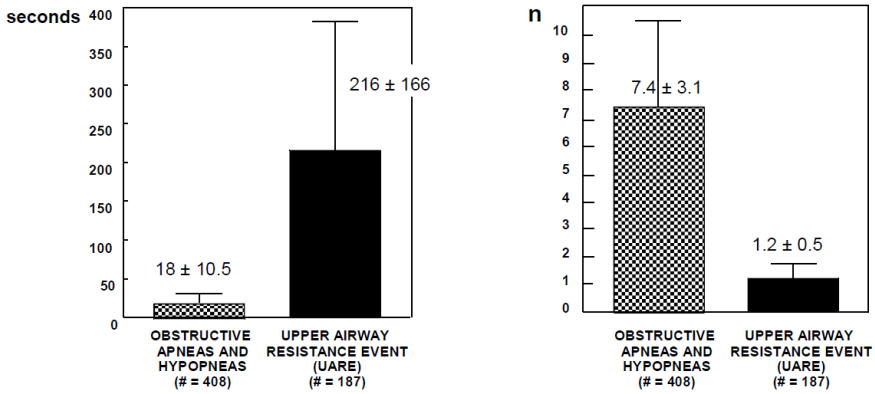

Figure 3:
LEFT - Mean duration of events (Mean ± SD).
RIGHT - Mean number of breathing cycles following the termination of the respiratory event (n ± SD).

During UARE, the mandible depression associated with oscillations in the respiratory frequency band was initiated at a Poes level of – 11.7 ± 7.4 cmH_2O and ended at – 30 ± 19.3 cmH_2O.

CONCLUSIONS:

1. The recording of mandibular activity during sleep by a distance-meter provides a surrogate of Poes for the diagnosis of UARS;

2. The abrupt elevation, following the progressive lowering of the mandible, is coincident with UARE arousal.