JAWAC: evolving technologies to study sleep disturbance in obese adolescents, a preliminary study

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Introduction

Childhood obesity has become as one of the most important global health problems of the 21th century and is associated with several short and long-term health hazards as cardiovascular, metabolic, orthopaedic and psychological diseases. Many of them present excessive daytime sleepiness and snoring, suggesting obstructive sleep apnoea syndrome (OAS). OAS constitutes another major public health problem because of its several pathophysiologic consequences such as cognitive disorders, cardiovascular and metabolic implications and decrease of quality of life. Severity of the disease is assessed on the calculation of the apnoea-hypopnea index (AHI), which is the number of apnoea- and hypopnea episodes per hour of sleep time. Untreated, OSA has important health and socioeconomic consequences, but efficient therapies are available and consequently its diagnosis is important. Currently, nocturnal polysomnography (PSG) is considered as the gold standard in the management of sleep-wake disturbances. Nevertheless, this device has important drawbacks and limited access. Diagnosis and treatment of OSA are therefore often delayed. Nowadays, different approaches have been explored to develop new technologies primarily for the diagnosis of obstructive sleep apnoea. Among these, JAWAC system measure mandible movement signal, that provides information on mandible activity. As some studies demonstrated a good correlation between the gold standard PSG analysis and the JAWAC system in adults, we used this technology in obese adolescents to assess the utility of that device in this population.

Material and methods

We studied children 12 to 16 years old suffering from obesity. For all patients, a nocturnal polygraph was recorded with the Somnolter, including nasal prongs, thoracic and abdominal belts, pulse oximeter, body position, and jaw movement sensors.

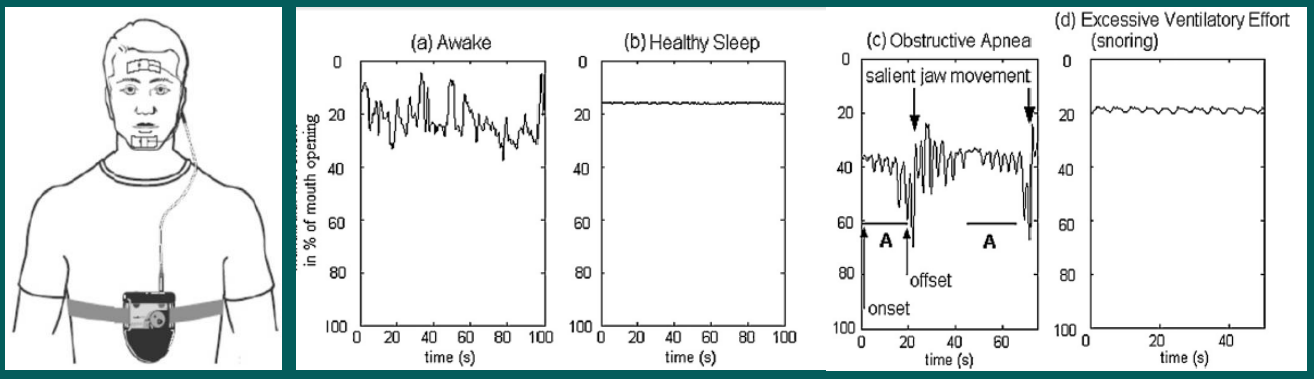
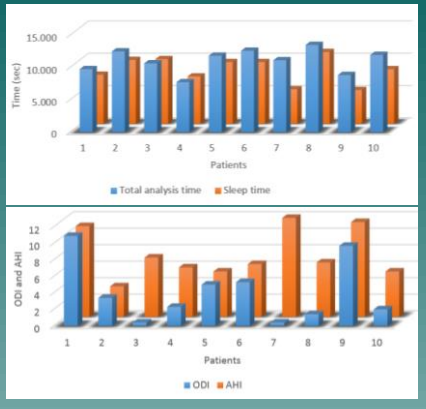


Figure *Left: the ambulatory portable JAWAC system, which records the mid-sagittal jaw movement. Right: Jaw movement patterns in (a) wake state, (b) healthy sleep, (c) obstructive apnoea and (d) snoring. The signal is expressed in % of mouth opening, i.e., 0% is the fully closed mouth level while 100% corresponds to a fully openend mouth*

Results

Respiratory events when they exist are characterized by oscillating jaw movements, more opened mouth and a salient mouth closure movement occurring after the event. Besides, recording the jaw movement signals allows the distinction between high jaw activities in wakefulness from no jaw movement in sleep, this system can thus better assess sleep time compared to the total analysis time.

The addition of mandible movement automated analysis significantly improved the apnoea-hypopnea index (AHI) calculation accuracy compared with an airflow and oxygen saturation analysis which measure the oxygen desaturation index (ODI).



Conclusions

JAWAC is an attractive method for the screening of obstructive sleep apnoea syndrome in adolescents. It increases the ability to detect hypopnea thanks to the salient mandible movement as a marker of arousals. Nevertheless, furthers studies are required to valid this system in children with different causes of sleep disturbances.