

## Event-Related Potentials during a Psychomotor Vigilance Task in Sleep Apnea Patients and Healthy Subjects

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### Introduction:

Event-Related Potentials (ERPs) recorded during cognitive tasks track the neurophysiological correlates of information-processing. Because Sleep Apnea (SA) patients exhibit excessive daytime drowsiness and impaired vigilance, ERPs were obtained during a Psychomotor Vigilance Task (PVT) to identify differences between SA patients and healthy subjects.

### Methods:

Twenty-eight healthy subjects (15 males; 13 females; mean age = 37, range 23-63) and twenty-seven patients (18 males; 9 females; mean age=43, range 22-65) diagnosed with SA (mean RDI=43, range 13-122) completed the ERP study between 8:00AM and 12:30PM. Visual ERPs were recorded from Fz and PO referenced to the left ear during a PVT. Subjects were required to respond to Primary and Secondary PVT stimuli presented for 200 ms at an 80:20 ratio with inter-stimulus-intervals (ISI) ranging from 1.5 to 10 seconds. Average, stimulus-locked ERPs from the correct responses, screened for excessive artifact, smoothed (20-Hz low-pass filter) and detrended for DC/linear offsets, were computed separately for each subject to 1,500 ms post-stimulus. To quantify the ERP components of interest, the maximum amplitude (MA), corresponding latency (LT), and mean positive amplitude (PM) in the ranges (identified in Figure 1 with vertical lines) 80-200(N1P2), 200-275(P3a), 200-475(Late Positivity), and 350-475(P3b) ms were computed for normals and SA patients and stratified by ISI into Fast-ISI (<7-secs) and Slow-ISI (≥7-secs) groups.

### Results:

2(group) X 2(ISI) ANOVAs were conducted for all of the variables at Fz and PO. As expected, when compared to healthy subjects, the SA patients evidenced much longer latencies for all components at Fz and PO for both Fast- and Slow-ISI ERPs(all p<0.05)(Figures 1,2). As predicted, larger amplitude ERPs for stimuli preceded by longer ISIs were observed for N1P2 and the Late Positivity at Fz and PO(all p<0.05)(Figures 1,2). Surprisingly, there were no significant interactions between group and ISI in any of the amplitude measures.

### Conclusions:

These data confirm previous reports of longer latency P300s for ERPs recorded from SA patients during an “oddball” paradigm (1,2). P300 amplitude reflects the degree or quality with which information is processed and P300 latency is a measure of stimulus classification speed—an index of the processing time required prior to response generation. Longer latencies were observed for all of the ERP components in the SA patients, suggesting an overall delay in speed of stimulus processing. As expected, stimuli preceded by longer ISIs elicited larger amplitude ERPs for all subjects, but no difference was observed between SA patients and controls. Delayed P300s have been related to the decline in cognitive abilities in dementing illnesses (3) and may be a result of chronic hypoxemia or excessive drowsiness in SA patients. Additional research is required to determine the functional significance of these results.

### References:

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- 3)Polich J, Ehlers CL, Otis S, Mandell AJ, Bloom FE. *P300 latency reflects the degree of cognitive decline in dementing illness*. Electroencephalogr Clin Neurophysiol, 1986;**63**(2):138-44.

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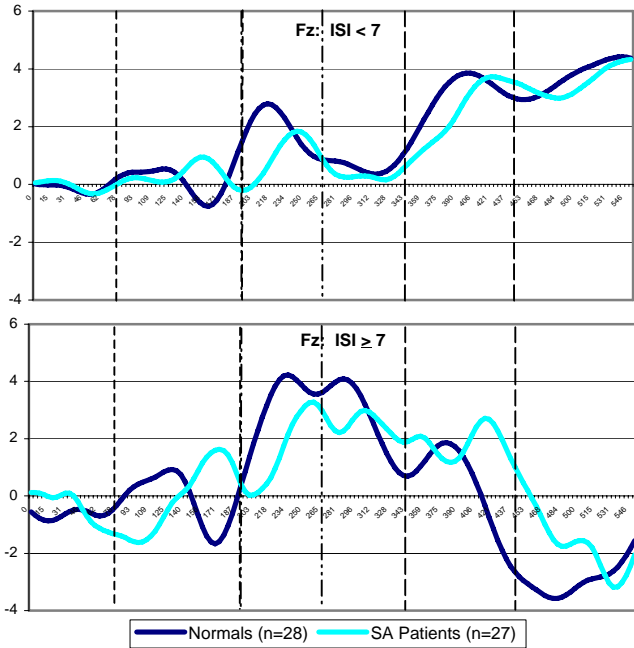


Fig 1: ERP's from Fz during PVT with a)  $ISI < 7$  and b)  $ISI \geq 7$ .

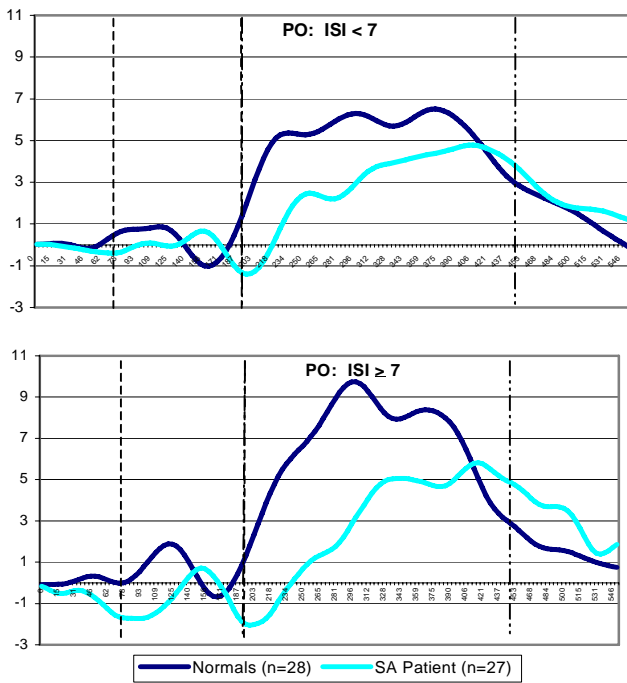


Fig 2: ERP's from PO during PVT with a)  $ISI < 7$  and b)  $ISI \geq 7$ .