

INVOLUNTARY ATTENTION DEFICIT IN PATIENTS WITH SHIFT WORK SLEEP DISORDER

Gumenyuk V¹, Roth T¹, Spear L¹, Jefferson C¹, Korzyukov O², Tepley N¹, and Drake CL¹

(1) Henry Ford Hospital Detroit, Michigan, USA; (2) Northwestern University, Illinois, USA



Introduction

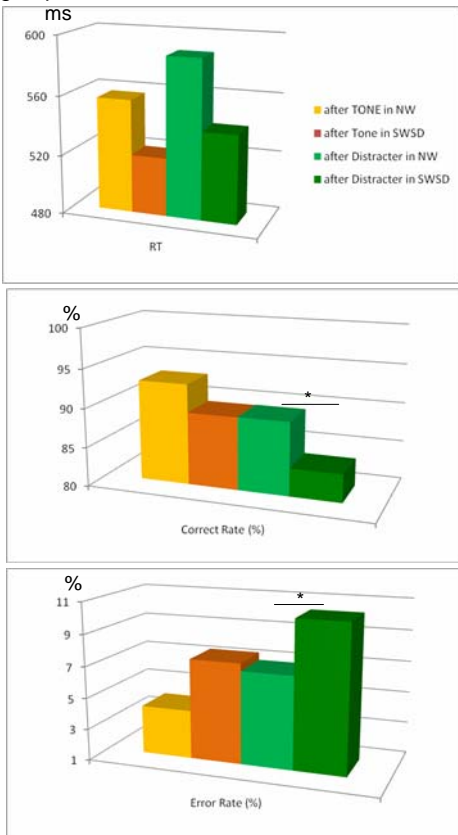
Shift Work Sleep Disorder (SWSD) is a sleep disorder that affects people who frequently rotate shifts or work at night. Some individuals have difficulty adjusting to the different sleep and wake schedule at non-traditional hours (usually between 2200 and 0600). SWSD consists of a constant or recurrent pattern of sleep interruption that results in *insomnia* or *excessive sleepiness*. This study evaluated the impact of SWSD on involuntary attention processes measured by event-related brain potentials (ERPs) and behavioral performance in night shift workers with and without SWSD.

Methods

SWSD patients (n=10) and matched control night shift workers (NW) (n=11) were screened for other sleep disorders. The EEG (32-ch EEG cap) was used for recording ERPs during performance of the auditory – visual distraction paradigm [1] administered at night hours between 2330 and 0100. ERPs associated with novel – distracter (P3aDISTR) and simple tone were compared between groups. Behavioral performance of visual task related to RT, correct- and error- rate was used to measure behavioral distractibility in both groups.

Results

Figure 1 illustrates the effect of auditory stimuli on behavioral performance of the visual task for both groups.



Behaviorally, although control group (NW) showed longer RT after both tone and distracting sounds as compared to RTs in SWSD, the significant ($P < 0.05$) lower correct responses and higher errors after distracting sounds indicate that SWSD group was more distracted than NW. In addition, the distracting sounds prolonged RT in both group as compared to RT after tone. The correct responses to visual stimuli decreased and errors increased after distracter in both group with respect to behavioral performance in response to tone.

Electrophysiologically, effect of the distracting sound on focused attention in the visual task was measured by P3a-distracter (P3aDISTR) ERP in both groups. Figure 2 illustrates ERP in both groups at FCz electrode.

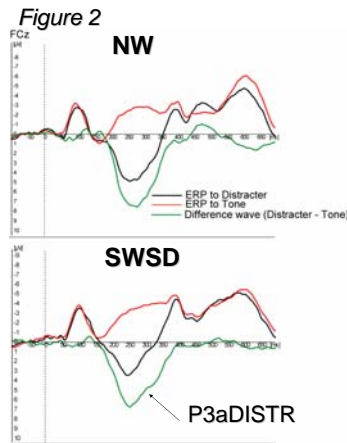
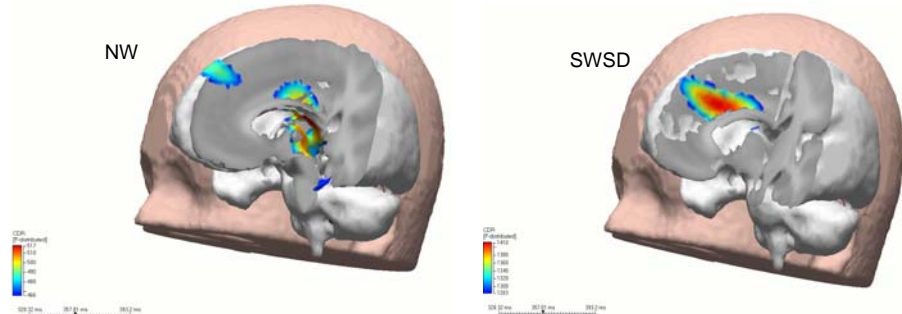


Figure 4 sLORETA of Electrophysiological Activity Associated With P3aDISTR



sLORETA analysis indicates that brain regions contributing to the process of allocation of attention to distracted events in healthy night workers are broadly active in contrast to reduced regional activities in the SWSD group, however, the activity in anterior cingulate region is increased with respect to control NW subjects.

Conclusions

The current study demonstrates that shift work sleep disorder is affecting the involuntary attention processes in permanent night shift workers who diagnosed with symptoms of SWSD. Thus behaviorally, SWSD group showed less correct responses and more errors after the distracting sounds as compared to healthy night workers. Electrophysiologically, the deficit of attention associated with reduced amplitude of P3a DISTR in SWSD group with respect to NW. sLORETA algorithms implemented in the CURRY software, is the so-called current density reconstruction method which is revealed distributed source of concurrently active electrical sources underlying P3aDISTR brain potential. This activity is reduced in SWSD patient possibly due to their symptoms of excessive sleepiness and/or insomnia. The current results are consistent with previous findings of research the P3a DISTR on Restless Leg Syndrome patients [2].

References and Acknowledgment

- [1] Escera C, Yago E, Alho K. Electrical responses reveal the temporal dynamics of brain events during involuntary attention switching. *Eur J Neurosci.* 2001 Sep;14(5):877-83
 [2] Poceta SJ, Houser M, Polich J. Event-related potentials in restless legs syndrome and Parkinson's Disease. *Sleep* 2006;28:A274.

This research was supported by Cephalon, Inc., and NIH R01 NS30914