The Effects of Cell Phone Use on the P3 of the Event-Related Potentials and on Response Time

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INTRODUCTION

Much concern has been raised about cell phone use and its harmful effects on the brain. The communication of neural networks for cognition and behavior rely on electrical and chemical signals. Researchers posit that cell phone frequency waves disrupt the neural pattern of communication, possibly compromising the function of the brain. Blackman et al. (1988), found that the response of brain tissue in developing chick embryos was altered by power-line electrical fields. Kenker et al. (2009) reported that the performance of their participants was impaired by cell phone conversations on a battery of cognitive tasks. Cell phone use affects cognitive functioning and behavior as indexed by observable overt behaviors. As such, there is a large population that is potentially at risk of the effects of cell phone on the brain.

Electroencephalography (EEG) involves the scalp recording of electrical activities were recorded using electrodes. The voltage fluctuations that occur in a time-locked portion of an EEG in a response to a stimulus are referred to as event-related potentials (ERPs). ERPs can be used to index cognitive functions such as selective attention.

Studies on attention have reported that the amplitude of the P3 is affected by concurrent and cognitive processes such as stimulus evaluation, detection, motor responding, and/or inhibition (Sutton et al., 1965; Picton, 1990; Shukla et al., 2000). This study used the P3 and reaction time to evaluate the effects of cell phone use on attention and the neural resources allocated to attention. The P3 component of the ERPs from EEG recording was used as a physiological measure during an AX-CPT condition. Reaction time recording was also used as a behavioral measure.

HYPOTHESES

1. Cell phone use is expected to affect P3 during selective attention.
2. Cell phone use is expected to affect the neural network for selective attention.
3. Cell phone use is expected to affect reaction time for selective attention.

METHODS

Participants
- EEG Data
  - 13 CSUN college students
Stimulus Parameters
- 1500 ms duration for each stimulus
- 387 stimuli; 40 target (GO) letter sequences
- Fz, Cz, Pz, Oz
- Reference to linked earlobes with a forehead ground
Recording Parameters
- Low frequency filter = 0.1 Hz; High Frequency filter = 100 Hz
- Vertical (VEOG) and Horizontal (HEOG) eye movements were recorded

RESULTS

P3 Amplitude and Topography
- No Significant Interaction Effect of Condition by Lead
  - F(2, 24) = 3.427, p = .075
- No significant difference in P3 amplitude between cell phone use and no cell phone use irrespective of leads
- No Significant Effect of Condition (C, NC)
  - F(1, 12) = .056, p = .817
- No significant difference in P3 amplitude between cell phone use and no cell phone use

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