Response Priming and Conflict Processing in Police Officers with PTSD Symptomatology: An Event-Related Brain Potential Study

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Introduction

Police officers, because of their stressful and often dangerous occupation, are at increased risk for developing Post Traumatic Stress Disorder (PTSD) compared to the general population. The demands for a state of high alert and ability to handle dangerous situations quickly and effectively may contribute to a general tendency for heightened arousal in police officers as well as an increased response to environmental priming cues for action. PTSD is characterized by four symptom clusters: intrusive thoughts, avoidance of threat-related stimuli, negative thoughts and feelings, and arousal and reactivity. Hyperarousal or hypervigilance are common symptoms of PTSD, belonging in the arousal and reactivity symptom cluster. Attentional problems are also often reported by PTSD patients and may be linked to hyperarousal or hypervigilance symptomatology such that PTSD patients have been found to show attentional bias toward threat-related stimuli as well as attentional deficits in the absence of threat-related stimuli. In the present study, differences in attentional/cognitive processes of response priming and conflict processing were investigated in police officers with PTSD symptomatology compared to civilian controls without prior trauma exposure using Event-Related Brain Potentials (ERPs) obtained during a continuous performance Go/NoGo task, the A-X CPT.

Method

Participants: 14 actively employed police officers with PTSD symptomatology (4 females, 10 males) and 11 civilian controls without prior trauma exposure (3 females, 8 males)

Clinical Review & Assessment: Police – Clinician Administers PTSD Scale (CAPS-DX) and Police Incident Survey; Controls – Life Events Checklist (LEC); Both – PTSD Checklist-Civilian Version (PCL-C); Beck Depression Inventory, 2nd Edition (BDI-II), Beck Anxiety Inventory (BAI), North American Adult Reading Test (NAART)
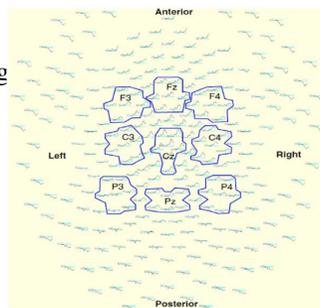
The Task – Go/NoGo A-X CPT:

E B A X G J X D A G L

A-prime Go   X-only   A-prime NoGo
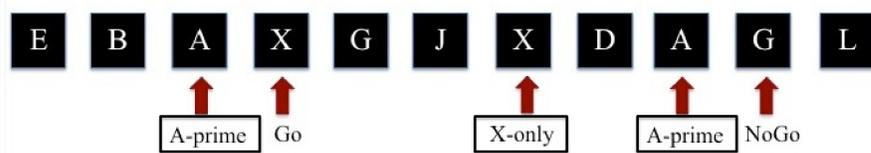
Letters were presented one at a time on a computer monitor. Participants were instructed to respond as quickly and accurately as possible to the letter "X" only when it was preceded by the letter "A." There were 410 total stimuli (total duration = 12.6 minutes) – 80 A-prime, 40 Go, 40 NoGo, 40 X-only, and 210 nontarget stimuli.

Electrophysiology & ERP Analysis: The scalp recorded electroencephalogram (EEG) was obtained during the A-X CPT using a 256-channel dense electrode recording system (Electrical Geodesics, Eugene, OR). Data was segmented into a window size of 650 msec (100 msec pre-stimulus to 550 msec post-stimulus). Artifact rejection procedures were preformed. ERPs for A-prime and X-only trial types are reported here and components N2 (200 ms – 400ms), and P3 (300ms – 500ms) were identified, examined in clusters of electrodes (see figure to the right), and analyzed along the midline (Fz, Cz, Pz) clusters.
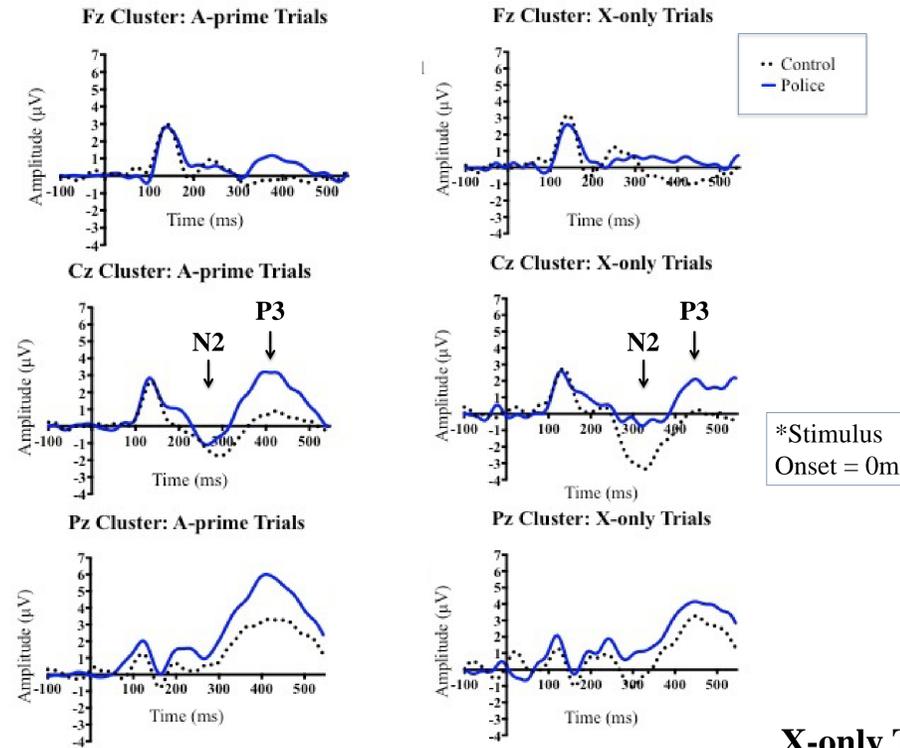
Statistical Analysis: Repeated measures ANOVAs were used to compare groups on both P3 amplitude and latency, and N2 amplitude and latency for A-prime and X-only trial types, separately: site (Fz, Cz, Pz) X group (police, control) & site (Fz, Cz) X group (police, controls) designs.

Results

Grand Averages

Fz Cluster: A-prime Trials / Fz Cluster: X-only Trials
Cz Cluster: A-prime Trials / Cz Cluster: X-only Trials
Pz Cluster: A-prime Trials / Pz Cluster: X-only Trials

Control / Police

N2   P3

*Stimulus Onset = 0ms

A-prime Trials

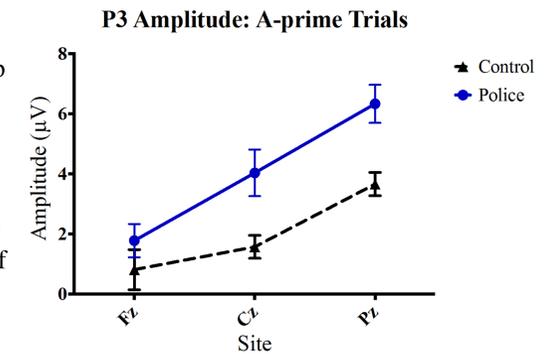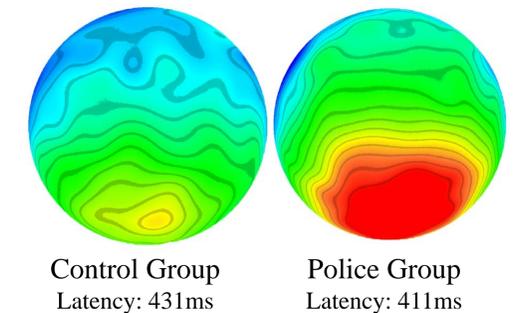P3 Amplitude: A-prime Trials

- **P3 Amplitude** – Group X Site ANOVA
- Group effect
  - F = 12.605, p = .002
- Police had greater P3 amplitude compared to controls, irrespective of scalp site.

Topographic Maps – P3 Amplitude (A-prime)

Control Group Latency: 431ms   Police Group Latency: 411ms
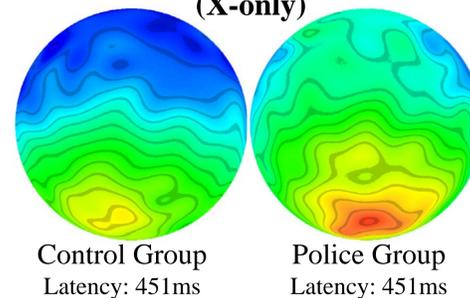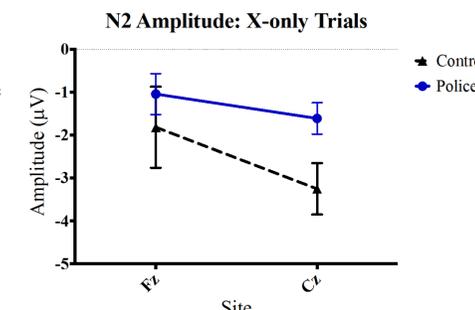
X-only Trials

P3 Amplitude: X-only Trials

- **P3 Amplitude** – Group X Site ANOVA
- Group effect
  - F = 6.275, p = .020
- Police had greater P3 amplitude compared to controls, irrespective of scalp site.

Topographic Maps – P3 Amplitude (X-only)

Control Group Latency: 451ms   Police Group Latency: 451ms
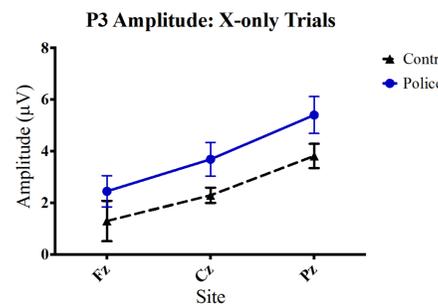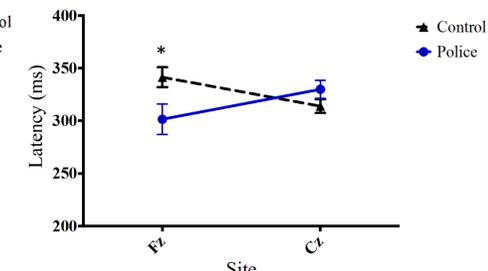
N2 Amplitude: X-only Trials

- **N2 Amplitude** – Group X Site ANOVA
- Trend toward significant Group effect
  - F = 3.405, p = .078
- Controls had larger N2 amplitude (more negative) compared to police, irrespective of scalp site.

Topographic Maps – N2 Amplitude (X-only)

Control Group Latency: 331ms   Police Group Latency: 325ms
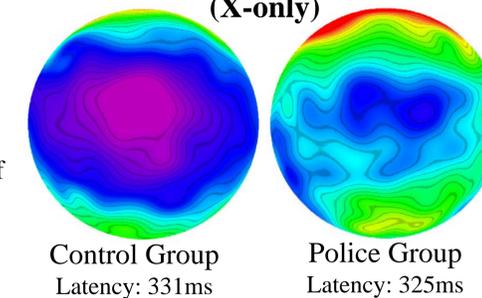
N2 Latency: X-only Trials

- **N2 Latency** – Group X Site ANOVA
- Group by Site interaction
  - F = 6.267, p = .020
- Police had shorter frontal N2 latency but showed no difference in central N2 latency compared to controls.

Summary and Conclusions

- P3 findings suggest heightened arousal in police officers compared to controls (greater P3 amplitude during A-prime trials).
- P3 findings also suggest heightened attentiveness in police officers compared to controls to conflicting nontarget (X-only) stimuli (greater P3 amplitude) indicative of possible hypervigilance in police officers with PTSD symptomatology.
- N2 findings suggest that police were able to detect conflict more quickly compared to controls (shortened frontal N2 latency during X-only trials). In addition, the borderline N2 amplitude effect suggests that controls used more effort (resources) when processing the conflicting nontarget (X-only) stimuli.
- Future work will examine how these ERP findings relate to the police officers' PTSD symptomatology.