EVENT-RELATED POTENTIAL INDICES OF ATTENTION AND MEMORY IN POST-TRAUMATIC STRESS DISORDER

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SUMMARY

Background – Previous reports of abnormal auditory N2 and P3 event-related potentials (ERPs) suggest impaired discrimination, evaluation or context updating for infrequent target stimuli in post-traumatic stress disorder (PTSD). This study examines each of these processes by investigating high-resolution ERP topography during target detection for visual word stimuli.

Method – ERPs were recorded at 124 electrodes from 10 PTSD patients and 10 matched controls. Target detection tasks comprised blocks of equally probable red and blue words, with low probability target events. Detection of fixed target words in one color provided the basis for measurement of selective attention for color, stimulus evaluation and target detection processing. Alternative task instructions, with the same stimuli, required detection of any consecutive word repeats in an attended color, which demands working memory updating for non-target words. Comparison of attended non-target words from each task indicates the extra activity for updating working memory representations of target attributes. Thus, specific condition comparisons provide measures of stimulus discrimination and evaluation, working memory updating and target detection.

Results – PTSD patients had slower and less accurate motor responses in both tasks, with greater inaccuracy during the variable target task. There was abnormal ERP activity in PTSD at 200-300 ms in the left posterior temporal region during stimulus discrimination and target recognition. During evaluation of attended non-target words, PTSD patients demonstrate deficits in frontal and parietal regions at 400-500 ms. During working memory updating, at 400-600 ms, there was a delay in frontal activation, followed by smaller activity in parietal areas in PTSD. During target word recognition, PTSD patients demonstrate deficits in frontal activity, with greater occipital and parietal activity.

Conclusions – These findings indicate impaired evaluation and integration of new information in working memory. In particular, the results suggest failure in frontal executive systems, with greater dependence on visual processing for effective target detection. The current findings are consistent with neuropsychology studies that identify deficits of attention and memory for verbal information in PTSD. This study provides insight into the temporal components of attention and working memory in PTSD. It is proposed that working memory deficits arise from disruption to synchronized activity in distributed networks engaged in working memory processes.

DECLARATION

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

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Darren Lee Weber

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All these intrusive recollections only have an experiential quality to them: when I have these flashbacks they are not explainable, I can't make things sequential. Up til now they had very little outline to them. Now a tiny fraction of these torture experiences have become knowable to me, but when I come closer to them and stop warding them off, I start having all sorts of problems of a different kind: I become confused, I lose things and start getting into accidents. The tragedy is the loneliness: the inability to convey the inner experience, and knowing that I cannot get out of it without going through it again.

A PTSD patient; cited in van der Kolk, Burbridge & Suzuki, 1997, p. 99

Humankind cannot bear very much lack of meaning. If we have to experience horror, there has to be a point. There has to be. In fact, it is not the horror itself that torments us so much as the need to understand. We have to get to the heart of the labyrinth where the minotaur lurks. We want to know that the labyrinth is mappable, that there is *a minotaur, that there is at least* something *at the core of things which is responsible for all this dread, and we want to reassure ourselves that if we trail Ariadne's thread behind us we can find a way out again.*

Janette Turner Hospital, *The Last Magician*, University of Queensland Press, 1995

This work is dedicated to the trauma victims, especially those who freely assisted this research. I hope that we can illuminate Ariadne's thread and the way out.

I am indebted to my supervisor, Dr. Richard Clark, for his faith in my capacities and the opportunities to work on exciting projects. Being enthusiastic and determined, yet not always dedicated to one purpose, the supervision was not always easy, but you provided a good balance of encouragement, persuasion and discipline. I've grown to understand, respect and value your guidance and the opportunities you generate, while I've also grown more confident in my own judgment. You've supported me well; I hope the work lives up to all your expectations.

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