



# MEMORY PERFORMANCE AS A FUNCTION OF ANXIETY IN INDIVIDUALS WITH AND WITHOUT MILD HEAD INJURY



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## Background

- Current research focuses on moderate to severe traumatic brain injury
- Little research examines the cognitive sequelae and emotional regulation following mild head injury (MHI).
- MHI - defined as physical trauma to the head via a biomechanical force sufficient to produce an alteration in consciousness<sup>1</sup>.
- Typically it has been suggested that post-concussive symptoms<sup>2</sup> subside after a three month period and functioning is assumed to return to previous abilities
- However, some individuals may have persistent psychological, behavioural, socioemotional, occupation and cognitive difficulties<sup>3</sup>, particularly memory, attention, inhibition, executive functions, and processing speed may also be hindered<sup>3,4</sup>.
- Furthermore, individuals with neurological compromise are particularly vulnerable to stress and anxiety<sup>5,6,7</sup>.

## Purpose

*Do limitations in memory performance persist in individuals with MHI for which organic damage is less easily verified to be permanent, and is in fact subtle (i.e. found in high functioning individuals such as university students)?*

*Are there potential interacting or exacerbating effects of stress/anxiety on memory performance in persons who have sustained a MHI?*

## Method

### Participants

University students ( $N = 50$ ); 30% reported history of MHI

### Measures and Procedure

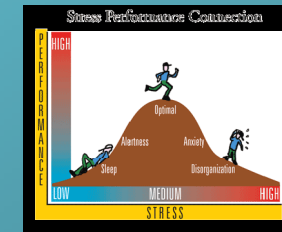
Standardized neuropsychological tests, questionnaires, and a structured interview were administered, including:

- Narrative memory - immediate and delayed (Wechsler Memory Scale®-Third Edition)
- Visuospatial memory - immediate and delayed (Rey Complex Figure test)
- Indices of anxiety - state and trait (State-Trait Anxiety Inventory)

## Discussion

As expected, subjects' level of arousal was found to impact memory performance (i.e. Yerkes-Dodson curve) for both verbal and spatial material. Individuals without MHI and heightened anxiety/arousal performed more poorly on memory tasks than persons with less arousal. Interestingly, overall, individuals with MHI reported an underaroused state compared to individuals without MHI; and those with relatively heightened anxiety performed optimally compared to their cohorts.

*Therefore, increased arousal advantages both accuracy performance and processing speed on memory tasks for individuals reporting a history of MHI.*



As predicted by the Yerkes-Dodson curve, too little arousal is associated with poor levels of performance (as in MHI) as is too much arousal (as in No MHI).

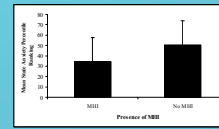
## Conclusions

These findings indicate the potential limitations of underarousal that has found to be associated with orbitofrontal disruption and may be implicated in MHI generally. They further demonstrate that the neurological and emotional sequelae following MHI may not be transient despite both the subtle nature of the head trauma and the competency of the individuals involved (e.g. successful academic performance). The results demonstrate that sustaining a MHI is predictive of long-term deficits in cognitive functioning, specifically memory performance which is differentially influenced by arousal.

### References

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- <sup>4</sup>Raskin, S. A., Maiters, C. A., & Tweeten, R. (1998). Neuropsychological assessment of individuals with mild traumatic brain injury. *The Clinical Neuropsychologist, 12* (1), 23-30.
- <sup>5</sup>Hanna-Pladdy, B., Berry, Z. M., Bennett, T., Phillips, H. L., & Gouvier, W. D. (2001). Stress as a diagnostic challenge for postconcussive symptoms: Sequelae of mild traumatic brain injury or physiological stress response. *The Clinical Neuropsychologist, 15* (3), 289-304.
- <sup>6</sup>Harvey, A. G., & Bryant, R. A. (1998). Acute stress disorder after mild traumatic brain injury. *Journal of Nervous and Mental Disease, 186*, 333-337.
- <sup>7</sup>Harvey, A. G., & Bryant, R. A. (2000). Two-year prospective evaluation of the relationships between acute stress disorder and Post Traumatic Stress Disorder following Mild Traumatic Brain Injury. *The American Journal of Psychiatry, 157* (4), 626-628.

## Results



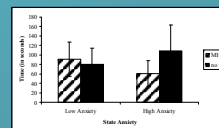
State anxiety levels differed between individuals with and without MHI,  $F(1, 48) = 4.23, p = .045$ .



Immediate,  $F(1, 48) = 4.02, p = .050$ , and delayed,  $F(1, 48) = 6.61, p = .013$ , narrative recall performance of individuals with and without MHI differed as a function of state anxiety.



Similarly, recall ability for thematic material for individuals with MHI and without MHI varied as a function of state anxiety for both immediate,  $F(1, 48) = 3.85, p = .056$ , and delayed recall,  $F(1, 48) = 3.93, p = .054$ .



Time required for completion of the delayed reproduction (after a minimum 30 minute delay), but not immediate reproduction, of the RCF did vary significantly between MHI and no MHI groups as a function of state anxiety,  $F(1, 48) = 4.47, p = .040$ .