

**The Effectiveness of EEG Biofeedback and  
Cognitive Rehabilitation as Treatments for  
Moderate to Severe Traumatic Brain Injury**

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**A research thesis submitted in partial fulfilment of the requirements for the  
degree, Doctor of Psychology (Clinical Neuropsychology), 2006**

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## **Declaration**

I, Joanne Stephens, declare that the Doctorate of Psychology (Clinical Neuropsychology) thesis entitled The Effectiveness of EEG Biofeedback and Cognitive Rehabilitation as Treatments for Moderate to Severe Traumatic Brain Injury is no more than 40,000 words in length, exclusive of tables, figures, appendices, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

Signature:

Date:

Joanne Stephens

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## Abstract

*Background:* Cognitive Rehabilitation is an umbrella term which encompasses a number of restorative and compensatory techniques commonly and widely applied to assist with the sequelae following traumatic brain injury (TBI). Such techniques have been well established within the literature. More recently, an increasing body of research has emerged suggesting that electroencephalography (EEG) biofeedback is an effective intervention for sequelae following TBI. The purpose of the study was to investigate the effectiveness of cognitive rehabilitation and EEG biofeedback as treatments for moderate to severe TBI. It aimed to determine the effectiveness of each intervention in treating cognitive, emotional, and behavioural sequelae following TBI. *Methods:* A multiple single case study cross-over (ABBA) design was used with six adult participants, no less than one year post TBI. Three of the participants received the two treatments in the opposite order to the remaining participants, each serving as their own controls. Over ten weeks, each participant received 20 hours of Treatment A. Then, following a ten week break they received 20 hours of Treatment B, with a final ten week follow-up. A number of cognitive, emotional, and behavioural measures were administered pre-post treatments. Quantitative electroencephalographs (qEEG) were also administered pre-post treatments to evaluate any change in the electrophysiological dynamics of the brain. *Results:* EEG biofeedback appeared to be more effective than cognitive rehabilitation in improving information processing impairments, namely, complex attentional control, response inhibition, and speed of language and comprehension. Cognitive rehabilitation appeared to be more effective than EEG biofeedback in improving visual memory. Both treatments were effective in reducing depression, anxiety, anger, and neurobehavioural symptomatology. Although both treatments were effective in reducing depression, greater reductions were evident following EEG biofeedback. A number of self-reported functional changes were also noted by each participant. EEG biofeedback was more effective than cognitive rehabilitation in the normalisation of dysregulated EEG (as measured by qEEG). *Conclusions:* Overall, EEG biofeedback appeared to be more effective in improving information processing skills, while cognitive rehabilitation was more effective in improving visual memory. Both treatments were effective in the treatment of emotional and behavioural sequelae following TBI. EEG biofeedback was more effective in normalising the participants' EEG. However, the clinical meaningfulness of the qEEG finding is questioned. Speculations are made about the possible functional brain changes which may occur following rehabilitation.