

# Assessment of Communication Improvement after Neurofeedback therapy

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# Introduction

- Electroencephalogram (EEG) neurofeedback is a new, alternative treatment option that is used to train the brain in order to regulate body functions. Brainwave patterns are monitored as neurofeedback teaches the brain to control certain frequencies of activity.
- There is evidence of neurofeedback's effectiveness for improving symptoms associated with attention deficit hyperactivity disorder (ADHD), learning disability (LD), and auditory memory functioning. Researchers are beginning to test neurofeedback for the treatment of other cognitive problems.



# Past Research

- Previous research has found significant improvements in the areas of attentiveness, impulse control, and consistency of response, among others, with the use of neurofeedback for ADHD/ADD.
- Neurofeedback has also been found to be effective for children and adults experiencing attentional problems.
- Improvements have been noted in studies of learning disabilities and memory functioning with neurofeedback therapy, as well.



# Purpose

- The purpose of this study was to investigate the effect neurofeedback has on communication deficits associated with TBI.



# Research Questions

- 1. Do test scores of cognitive linguistic function improve after neurofeedback treatment in an individual with TBI?
- 2. After neurofeedback training, what functional communication improvements are seen in an individual with TBI?



# Participant

- The participant for this case study was an 18:7, right-handed female with a history of TBI (JR).
- In October 1996 at age 11, JR sustained an open frontal skull fracture above her left eye. JR sustained a second TBI in November 2001, at age 16:1. TBI involved a blood clot between the two hemispheres, left facial droop, and reduced mobility due to left paresis of arm and leg.



# Assessment

- Pre-testing
  - Formal pre-testing
    - Scales of Cognitive Ability for Traumatic Brain Injury (SCATBI)- measures performance in the areas of perception/discrimination, orientation, organization, recall, and reasoning (normed on TBI).
    - The Recognition Memory Subtest (RMT)- a normed test of working memory involving judgments about the prior occurrence of words presented by audiotape.
    - The Boston Naming Test (BNT)- a confrontational naming test.
  - Formal pre-test administered by a psychologist at Midwest Neurofeedback
    - The Test of Variables of Attention (T.O.V.A.)- administered as a baseline of brainwave activity



# Assessment

## – Informal testing

- Profile of Executive Functioning (Pro-Ex)- a functional independence questionnaire that is completed by a family member or significant other.
- Self-evaluation- rating scale used to indicate a change in skills since injury.



# Reliability

- Inter-rater reliability was established by independent scoring of all tests by this researcher and the faculty mentor.
- Results were compared and discrepancies were discussed until agreement was reached.



# Neurofeedback Training

- Experimental Procedures
  - 90 hours of neurofeedback therapy was given by Midwest Neurofeedback.
- Brain activity is displayed on a computer that the administrator uses to obtain information about particular brainwave frequencies. These brainwaves are observed as the trainee watches a video game/display and is instructed to play a game with their brain by staying attentive to the video (EEG Spectrum International, 2003). Beta activity (fast activity associated with high alertness, concentration, and focused attention) was reinforced.



# Results

## Question 1

- Post-testing
  - Formal testing:

	Pre-testing	Post-testing
Scales of Cognitive Ability for Traumatic Brain Injury	100	119
The Recognition Memory Subtest	104	103
The Boston Naming Test	46	51

Pre and Post Testing T.O.V.A. Scores

Omission errors	November, 2002	October, 2004
1 <sup>st</sup> quarter standard scores	106	104
2 <sup>nd</sup> quarter standard scores	40	82
3 <sup>rd</sup> quarter standard scores	40	69
4 <sup>th</sup> quarter standard scores	60	95
Commission errors		
1 <sup>st</sup> quarter standard scores	85	87
2 <sup>nd</sup> quarter standard scores	110	95
3 <sup>rd</sup> quarter standard scores	61	70
4 <sup>th</sup> quarter standard scores	66	61
Response time, msc*		
1 <sup>st</sup> quarter standard scores	<40	93
2 <sup>nd</sup> quarter standard scores	<40	84
3 <sup>rd</sup> quarter standard scores	74	118
4 <sup>th</sup> quarter standard scores	78	113
Response time variability, msc*		
1 <sup>st</sup> quarter standard scores	53	104
2 <sup>nd</sup> quarter standard scores	77	94
3 <sup>rd</sup> quarter standard scores	86	96
4 <sup>th</sup> quarter standard scores	83	102

*Note.* Scores are reported as standard scores. \*msc= milliseconds.



# Results

## Question 2

### ■ Functional Improvements

- Pro-Ex: Areas of improvement follow:
  - Planning/sequencing- Pre-test: 4/7 Post-test: 6/7
  - Initiation- Pre-test: 3/7 Post-test: 6/7
  - Execution- Pre-test: 2/7 Post-test: 6/7
  - Time sense- Pre-test: 3/7 Post-test: 6/7
- Self-evaluation rating scale: Areas of improvement follow:
  - Requesting help when needed- Pre-test:  $\frac{1}{4}$  Post-test:  $\frac{3}{4}$



# Discussion

- Findings suggest that neurofeedback therapy may have been an effective treatment method for cognitive communication deficits experienced by the participant in the areas of recall, reasoning, sustaining attention, response time, and response time variability. The participant was medically stable and would not be expected to improve test scores over time.
- Functional areas improved included planning/sequencing, initiation, execution, time sense, and requesting help when needed.



# Implications and Limitations

- Neurofeedback may be an important supplemental tool for some patients with TBI who have failed to reach their potential with traditional treatments and therapies.
- This was a retrospective study that included only one participant.
- Future research is needed to determine if this form of alternative therapy will be beneficial for cognitive communication deficits experienced due to traumatic brain injury.



# References

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