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Neurofeedback Training to Enhance Learning and Memory in Patients with Cognitive Impairment

Parvaneh Haddadi, ^{*a}, Reza Rostami, ^b, Afsaneh Moradi, ^c, Farzaneh Pouladi, ^d

^{a,b,c & d}Department of Psychology, University of Tehran, P. O. Box 14155-6456, Tehran, Iran

Abstract

The brain tumours can make cognitive impairment especially when they involve the limbic system, the frontal or temporal lobes. The aim of the present study was to examine neurofeedback training (NFT) to enhance learning and memory in patients with cognitive impairment. Single case pre- and post-intervention study was adopted. The qEEG WISC-IV and CBCL test was compared pre and post NFT. Patient was given 40 sessions of NFT, 45 min / day, 3 days a week. The training incorporated video feedback to increase the frequency of Beta waves (15-18 Hz) and to decrease theta waves (3-7 Hz) in T3 and F3. Also, SMR training was performed in Cz to decrease the seizure attacks. qEEG showed prominent different in the brain activity. Results indicated decrease in theta and increase in Beta waves. The present study puts forward that NFT should be taken into account to plan for rehabilitation of patients with cognitive impairment for enhancement of performance in the school or university.

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Keywords: Neurofeedback, Cognitive impairment, Brain tumour, Learning, Memory;

1. Introduction

An acquired brain injury commonly results in a change in neuronal activity, which affects the physical integrity, the metabolic activity, or the functional ability of the cell. An acquired brain injury may result in mild, moderate, or severe impairments in one or more areas, including cognition, speech-language communication; memory; attention and concentration; reasoning; abstract thinking; physical functions; psychosocial behaviour; and information processing (Giacino, & Zasler, 1995). Many patients with brain tumours experience changes in memory, thinking, or emotions since the diagnosis of a tumour or its treatment (Raskin & Mateer, 2000). In fact, studies have documented cognitive impairments in as many as sixty to ninety percent of patients with brain tumours.

This research is about a 12 years old boy. When he was 7, He had to surgery as a result of brain tumour at left frontal. After surgery, he had some symptoms include fatigue, headache, trouble sleeping; cognitive changes such as poor concentration, memory problems, slow performance, difficulty putting thoughts into words; and depression, anger and irritability. Seizure attacks usually were occurred 1 or 2 times per week. He had a lot of problems at school.

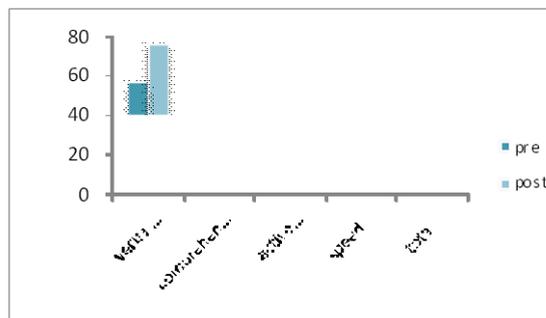
He experienced depression about his memory deficits. Theta and delta activities were high at left frontal. Beta activity was too low at left frontal. Theta and delta activities occur in the normal brain as the patient descends into sleep. If the patient is awake, any slowing of electrical activity in a focal area of the brain may indicate a lesion there. Neurofeedback Training (NFT) is a state of art training based on operant conditioning. It requires an individual to modify the amplitude, frequency or coherency of the electrical activity and learn to influence the

* Parvaneh Haddadi, Tel: + 912 772 2313
E-mail address: Hadadi.p@gmail.com

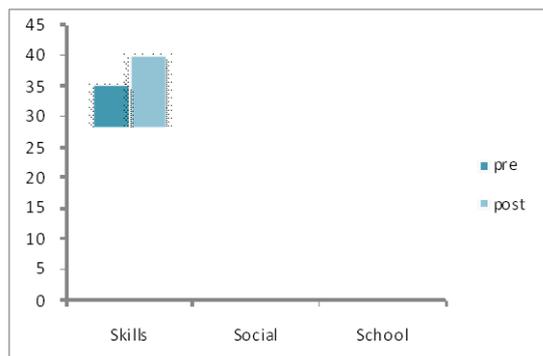
T5, T6, C3, C4, CZ, P3, P4, PZ, O1 and O2 during rest time. Lower activity than normal was observed special at left frontal just a tumour area. Beta oscillations (15-18 Hz) were too low at left frontal; theta oscillations (3-7 Hz) were too high. He was given 40 sessions of NFT, 45 min / day, 3 days a week. Electrodes were placed according to the 10–20 International System on T3, F3, with two reference and one ground point. The training wants to increase beta and decrease the frequency of theta oscillations. SMR training on Cz was used to control the frequency of seizure attacks. Pre and post WISC-IV, CBCL and qEEG were recorded for comparison.

3. Result

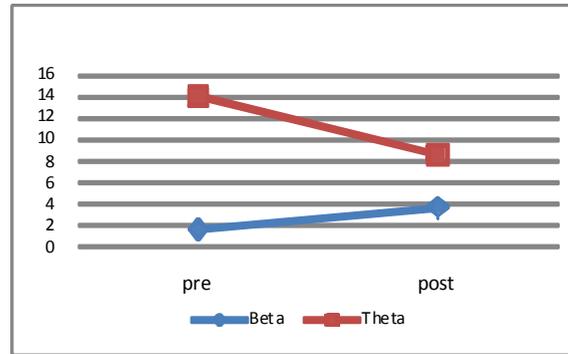
The post qEEG demonstrated significant changes from the pre training in the Beta and theta oscillations. There was increase in beta and decrease in theta oscillations. There was significant improvement on WISC. There were positive results in CBCL. In the basis of parent report, there was relative progress at school performance. Graphs 1, 2, 3 are showing the scores on WISC-IV, CBCL, and Beta - Theta pre- and post training.



Graph 1: showing the score of WISC-IV pre & post intervention



Graph 2: shows the scores of CBCL per & post intervention



Graph 3: showing the pre post Beta & Theta scores

4. Discussion

The aim of this study was to investigate the effect of neurofeedback training to enhance cognitive deficits in patients with acquired brain injury. Cognitive decline is increasingly recognized as an important consequence of acquired brain injury. In fact, studies have documented cognitive impairments in as many as sixty to ninety percent of patients with brain tumours. Results showed increase in beta and decrease in theta oscillations. Reduction of slow oscillations which is presentation of immaturity in these patients with cognitive impairments could be signaling the growth of their brain. On the other hand, improvement in learning and memory can be explained with increasing beta oscillations, which has an important role in learning and memory. Significant improvement was observed in social and school performance. His seizure attacks were totally eliminated. These findings suggest that the neurofeedback training can serve as a beneficial instrument to help patients with acquired brain injury.

5. Conclusion

Our experience shows that:

- Neurofeedback Training in these patients improve memory and cognitive skills.
- Neurofeedback training can be seen as a treatment for rehabilitation of the brain injuries at patients.
- There was increase in beta and decrease in theta frequency.
- However there is greater need for further work with large sample.

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