

Determination of the Effectiveness of Neurofeedback on Reducing the Symptoms of Hyperactivity and Increasing the Accuracy and Caution in ADHD Children

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Received: July 12, 2016

Accepted: August 26, 2016

Online Published: September 19, 2016

doi:10.5539/ass.v12n10p222

URL: <http://dx.doi.org/10.5539/ass.v12n10p222>

Abstract

This study is done to determine the effectiveness of Neurofeedback on reducing the symptoms of Hyperactivity and increasing the accuracy and caution in ADHD children. Subjects were 30 ADHD children who were selected by cluster sampling method. Research layout is pre-test, post-test experimental type. Conners parent measure questionnaire and a computer based continuous performance test are the research materials. The results of investigation on post-test average score of Hyperactivity symptoms and accuracy and caution of ADHD children in experimental and witness groups, with controlling of pre-test, has shown a significant difference.

Keywords: Neurofeedback, Hyperactivity symptoms, carelessness

1. Introduction

Attention-Deficit/Hyperactivity Disorder (ADHD) is a behavioural growth disorder. This child doesn't have the concentration and accuracy ability; learning is slow and has very high unusual activities. Most of these children have one or more other behavioural disorders (Sahim, 2012). Epidemiology researches show that, this disorder happens in 3 to 5 percent of school children (Dopal & Barklly, 1949; Brown, 2007). The range of this disorder is 9 times more in boys in a ratio of 2 to 1. This is more common among first boys of family. ADHD sister and brothers may probably be more affected by this disorder and other disorders like Gslnhd behaviour disorders, anxiety disorders and depression disorders. Their brothers and sisters probably get the lowest scores in achievement tests and the instances show the academic failure.

Their parents show the high level of sociopathy, alcoholism and hysteria. Although the disorders' initial age is 3, the diagnostic time is kindergarten or school time, when some information are received from child's teacher in comparison with his peers accuracy and impulsivity (Kaplan, Sadook, 2000, Poor Afkari, 2005; Broom, 2007). ADHD disorder is because of a complicated interaction between genetic, environmental and neurobiological factors (Kieling, Goncalves, Tannock and Gastellanos, 2008; Mick and Faraone, 2008). It seems that genetic and environmental factors lead to Neurobiological differences which cause the appearance of ADHD symptoms (Biderman, Faraone, 2002). Genetic and Neurobiological factors have the main roles in ADHD symptoms (Barklly, 2006). Furthermore it's obvious that environmental factors have the least important role in appearing this disorder (Das Banerjee, Middleton, and Faraone 2007). However documentary researches based on neurologic ABC disorders, are neglected. The outputs of these studies have a specific implication about the role of frontal lobe. Frontal lobe functions have administrative nature role in planning and organizing sources and also have a vital role in prohibitive mediator behaviours like controlling movement behaviour and deprivation from concentration on unrelated stimulus or distractor. Instances show that right frontal lobe disorder is the base of carelessness disorders. Neurofeedback is a kind of rehabilitation way to cure ADHD. It is going to stable and fix the normalized behaviour without permanent dependency on drugs or behaviour therapy. Neurofeedback accepts the neurologic base of this disorder. With regards to children, teenagers and adults who are affected by carelessness, in comparison with normal people, have more slow brain waves and less Beta activities. Neurofeedback is trying to teach patients to normalize their brain waves in to stimuli. Lobber claims that the main basic hypothesis in using Neurofeedback in ADHD treatment, is this phrase: If ADHD /ADD is specially

accompanied with malfunction in cortical level and pre-frontal lobe function and also if this basic Neurobiological disorder is reform able, the ADHD/ADD children will be able to show paradigms and guidelines which healthy children, had them in advance. To continue EGG changes and clinical changes, Neurofeedback sessions should be 20 to 80 (40 to 60 minutes). Several studies have shown that this method is useful in reducing hyperactivity, increasing accuracy and concentration, increasing IQ scores, parent's satisfaction of children behaviour and reforming indexes of continuous accuracy which is evaluated through function appraisal like TOVA. But this method has reviewers like Barklly who is the most prominent and famous theorist. Recent case studies in Neurofeedback have concluded that the primary studies are satisfactory. But some highhanded, scientific and stricter controlling studies are needed. Although ADHD field is using a useful method without medicines, but based on experimental outputs, we can't recommend using EGG biofeedback in clinical treatments. According to what mentioned, this study is done to determine the effectiveness of Neurofeedback on reducing hyperactivity symptoms and increasing accuracy and caution in ADHD children. The following hypothesis have been tested in this study 1) main hypothesis: Neurofeedback has effect on reducing hyperactivity symptoms and increasing accuracy and caution in ADHD children. 2) Secondary hypothesis: 2-1: Neurofeedback has an effect on reducing hyperactivity symptoms in ADHD children. These hypotheses have been tested. 2-2. Neurofeedback has effect on increasing accuracy and caution in ADHD children.

2. Method

This research has been done experimentally by pre-test/ post-test plan. Experimental and witness groups were selected accidentally. Some pre-test has been done in both groups before applying experimental interferences. There was also a post-test at the end of the interferences. Differences between pre-test /post-test in each group were investigated to be statistically significant. A month later a tracking test was done. So the effectiveness of Neurofeedback as an independence variable, used to show the effectiveness of reducing Hyperactivity symptoms and increasing accuracy and caution in ADHD children in Ahvaz as a dependent variable.

2.1 Sampling Size and Sampling Method

Sample size was 30 ADHD children which were selected by cluster sampling method. Two experimental and witness groups (15 members each). Experimental group were children who were introduced to consultative centres. Witness group were selected from some schools by availability method. Experimental group passed Neurofeedback sessions (3 times a week for two months). Both groups were taken pre- test/post-test.

2.2 Research Materials

Koners rating scale- parents' form: This scale has 48 questions which involve 5 main factors: behaviour problems, learning problems, psychosomatic, hyperactivity, impulsivity and anxiety. Khoshabei & Pooretemad on their research of 2667 boys and girls students (7-12) from Tehran showed that parents' form reliability was 93.0. Based on α -Cronbach method. For authenticating this scale, they used main elements analysis and rotating functional matrix, they achieved the same results. Each question of this scale has 4 choices (0-3), they'll get \leq at all, a little, pretty much, too many \geq . Parents' ranges of scores are 0 to 144.

Continuous performance Test: This test was designed by Razvld, et al, (1956) and was accepted by all. This test is the main and most common laboratory test in ADHD evaluation. 2 to 3 backgrounds show that this test is a good material to measure the vigilance, maintenance, accuracy and inwardness. In most group studies in which ADHD children's function is compared with normal children, it is obvious that ADHD function is significantly weaker than normal children. This test has correlation with subscales of memory numerical symbols and Mazes in Ksler children test (these scales are sensitive to carelessness and impulsivity). It has positive correlation with teacher and parents rating of carelessness and hyperactivity in children. Most of researches show that. It's a good way to recognize careless and impulsive children. In an overview of research which has been done by CPI test, reliability coefficient of test is reported by retesting the above cases (Carcom, Cycle, 1993). In most of their researches, this test was able to distinguish ADHD and normal children by deleting errors and demonstration. Furthermore it is possible to clarify the intensity of carelessness and impulsivity in children. They conclude that this test is a good material in clinical and research cases.

Hadian fard in 2000 in a research measured the reliability of this test by reviewing in a 20 days period. 43 primary school boys answered this test in testing and reviewing phase. Correlation was considerable. Table 1 shows the results in testing phase and Table 2 shows the results in reviewing phase; Table 3 shows reliability correlation in reviewing test. Reliability of the test is determined by comparing the average function of 30 normal primary school boys and 25 ADHD who are recognized by psychologist as hyperactive. Statistical comparison of both groups in different test, is a significant different in 0.001 level, between the function of two

groups. Table 4 shows the T-statistical results in two groups (Hadian fard, 2000).

3. Results

Table 1. Descriptive indicators of Continuous Performance test on 43 primary school boys

Scores	M	SD	Minimum Score	Score
The number of correct answers in 50 first stimulus	46.33	3.29	36.00	50.00
The number of deleted answers in 50 first stimulus	1.42	1.71	0.00	7.00
The number of given answers in 50 first stimulus	2.26	2.42	0.00	11.00
The number of true answers in 50 second stimulus	46.07	3.58	35.00	50.00
The number of deleted answers in 50 second stimulus	1.35	1.84	0.00	9.00
The number of given answers in 50 second stimulus	2.58	2.62	0.00	12.00
The number of true answers in 50 third stimulus	46.95	2.98	39.00	50.00
The number of deleted answers in 50 third stimulus	1.30	1.60	0.00	7.00
The number of given answers in 50 third stimulus	1.74	2.32	0.00	8.00
all true answers in test	139.35	8.97	110.0	149.00
all deleted answers in test	3.37	4.08	0.00	21.00
all given answers in test	6.30	6.79	0.00	31.00

Table 2. Descriptive indicators of Continuous Performance test on 43 primary school boys in retesting phase

Scores	M	SD	Min	Max
The number of correct answers in 50 first stimulus	46.53	3.40	39.00	50.00
The number of deleted answers in 50 first stimulus	1.37	1.80	0.00	7.00
The number of given answers in 50 first stimulus	2.09	2.22	0.00	9.00
The number of true answers in 50 second stimulus	46.37	2.91	39.00	50.00
The number of deleted answers in 50 second stimulus	1.56	1.71	0.00	8.00
The number of given answers in 50 second stimulus	2.07	2.10	0.00	9.00
The number of true answers in 50 third stimulus	47.09	3.08	39.00	50.00
The number of deleted answers in 50 third stimulus	1.37	1.59	0.00	7.00
The number of given answers in 50 third stimulus	1.47	1.98	0.00	8.00
all true answers in test	140.09	8.48	118.0	150.00
all deleted answers in test	3.12	3.30	0.00	17.00
all given answers in test	5.47	5.79	0.00	26.00

Table 3. Reliability coefficient (retest) of Continuous Performance Test

Different scores of all parts of test	Retest coefficient	Different scores of test	Retest coefficient
Correct answer in 50 first stimulus	0.8522	Correct answer in 50 third stimulus	0.7921
Deleted answer in 50 first stimulus	0.5911	Deleted answer in 50 third stimulus	0.4895
Given answer in 50 first stimulus	0.6457	Given answer in 50 third stimulus	0.7467
Correct answer in 50 second stimulus	0.7729	Correct answer in test	0.9342
Deleted answer in 50 second stimulus	0.8164	Deleted answer in test	0.9018
Given answer in 50 second stimulus	0.6161	Given answer in test	0.7225

Table 4. The comparison of Continuous Performance Test results in 30 normal and 25 ADHD subjects by using T test

scores	T	DF	Sig
The number of correct answers in 50 first stimulus	7.58	53	0.001
The number of deleted answers in 50 first stimulus	5.60	53	0.001
The number of given answers in 50 first stimulus	4.18	53	0.001
The number of true answers in 50 second stimulus	6.91	53	0.001
The number of deleted answers in 50 second stimulus	4.11	53	0.001
The number of given answers in 50 second stimulus	5.29	53	0.001
The number of true answers in 50 third stimulus	6.49	53	0.001
The number of deleted answers in 50 third stimulus	4.49	53	0.001
The number of given answers in 50 third stimulus	4.86	53	0.001
all true answers in test	8.70	53	0.001
all deleted answers in test	5.48	53	0.001
all given answers in test	5.51	53	0.001

Table 5. The results of studying default homogeneity of Regression slopes of research variables in both groups

variable	Sources of changes	F	Significance level
Hyperactivity symptoms	Pre-test group interaction	1.75	0.196
Accuracy and caution		1.15	0.293

Table 6. Hyperactivity symptoms, accuracy and caution in ADHD children in experimental and witness groups by controlling pre-test

Test	Amount	Hypothesis DF	Error DF	F	Significance level	Chi Eta	Statistical power
Testing the effects of Pylayy	0.622	2	25	20.53	0.0001	0.62	1.00
Wilks Lambda test	0.378	2	25	20.53	0.0001	0.62	1.00
Hotelling trace test	1.64	2	25	20.53	0.0001	0.62	1.00
The biggest test root	1.64	2	25	20.53	0.0001	0.62	1.00

Table 7. The results of one-way covariance analysis in Man Cova text on post-test scores average of hyperactivity symptoms, accuracy and caution in ADHD children in experimental and witness group by controlling pre-test

variable	Source of change	Sum of squares	Degrees of freedom	Mean square	F	P significance level	Chi Eta	Statistical power
Hyperactivity symptoms	Pre-test	7577.71	1	7577.71	69.37	0.0001	0.72	1.00
	group	3971.56	1	3971.56	36.36	0.001	0.58	1.00
	error	2839.96	25	109.22				
Accuracy and caution	Pre-test	920.07	1	920.07	82.00	0.001	0.75	1.00
	group	262.18	1	262.18	23.36	0.001	0.47	0.996
	error	291.71	25	11.22				

4. Conclusion

As you can see in Table 5, for all variables, F is significant. So regression homogeneity assumptions are accepted. First hypothesis: Neurofeedback has an effect on reducing hyperactivity symptoms and increasing accuracy and caution in ADHD children. Hypothesis 1.1 Neurofeedback has an effect on decreasing hyperactivity symptoms in ADHD children. Hypothesis 2.1. Neurofeedback has an effect on increasing accuracy and caution in ADHD children.

As it shown in Table 6, by controlling pre-test, significance levels of all tests show that, in ADHD children, experimental and witness group have a significant different(hyperactivity symptoms and accuracy and caution) at least in one dependent variable ($F = 20.53$, $p < 0.0001$). So the first hypothesis is accepted. To know the point that from which aspect the variable in both groups are different, two one-way covariance analyses in Mancova text are done. Results are shown in Table 11. The effectiveness or different amount is %62. In other words 62 percent personal differences in hyperactivity symptoms in post-tests and accuracy and caution, are related to neurofeedback effectiveness (membership). Statistical power is 1/00. In other words there is no possibility of second type error. As it shown in Table 7 by controlling pre-test in ADHD children, experimental and witness groups have significant different symptoms.($p < 0.10001$), ($F = 36.36$).

So hypothesis 1-1 is accepted. In other words, by considering the hyperactivity symptoms average in experimental children in post-test in relation to witness group average, Neurofeedback reduced the hyperactivity symptoms in experimental group. The level of effectiveness or difference is 0.58. In other words 58 percent personal differences in post-test scores in hyperactivity symptoms are related to the effectiveness of Neurofeedback (membership). Statistical power is 1.00. In other words, there is no possibility of second type error. By controlling pre-test. ADHD children experimental and witness groups have significant differences in accuracy and caution. ($F = 23.36$, $P < 0.0001$). So hypothesis 1-2 is accepted. In other words considering the accuracy and caution in experimental group in post-test, in relation to the witness group average, will lead to increase the accuracy and caution in experimental group. The effectiveness or difference level is 47%. In other words, 47 percent personal differences in post- test scores of accuracy and caution test is related to the Neurofeedback (membership). Statistical power is %996. This means if this research repeated 1000 times, there are just 4 possibility of null hypothesis acceptance.

5. Research Limitations

1. Participants in Neurofeedback sessions for ADHD children in experimental group were hard, because it leads to distraction.
2. Finding ADHD children as witness group was time consuming.

6. Research Suggestions

1. It is recommended that, in the case that Neurofeedback is used to treat disorders, it is a good idea to study and investigate it for other mental disorder treatments.
2. It is recommended that, to facilitate the researchers' activities, to preview the Neurofeedback function on patients, it should be a glass wall in treatment room to give the chance to see the function by researcher without any distraction.
3. With regards to the effectiveness of Neurofeedback on disorders like: ADHD, anxiety disorders, depression disorders... It is recommended that more ads present to introduce this treatment to warrant people about this method.

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