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The Contribution of Biofeedback Brain Boy Method to the Treatment of Anxiety Disorders

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ABSTRACT

Introduction: Anxiety management is one of the most important health issues which is being faced by humans today. Biofeedback, as a method of neurophysiology, has been added to the methods recommended for this purpose. **Aim:** The aim of the study was to measure the effectiveness of biofeedback method by using Brain Boy Universal Professional in the treatment of anxiety disorders. **Methods:** The sample of this research study consisted of 50 individuals, suffering from symptoms of anxiety, who underwent biofeedback therapy. For the purposes of this study, the self-administered questionnaire Hamilton Rating Scale for Anxiety was completed by the individuals both before the initiation of the therapy and after individuals had completed ten sessions of treatment with biofeedback. **Results:** Prior to biofeedback, 26% of the participants showed mild to moderate anxiety, 12% a medium severity of anxiety and the remaining 62% severe anxiety. After the completion of 10 sessions of biofeedback, 78% of the participants was found to experience mild to moderate anxiety, 12% a medium severity of anxiety and only 10% of severe anxiety. **Conclusion:** Biofeedback can be a therapeutic method for the treatment of anxiety disorders, giving treatment to patients who do not respond to drugs but also to patients who want to apply to undergo such treatment alongside other therapeutic methods including drugs.

Keywords: stress, anxiety, biofeedback.

1. INTRODUCTION

Biofeedback has been used for over seventy years, its roots embedded at the beginning of learning, in the field of experimental psychology and neurology (1). It is a process in which instruments accurately measure normal activity such as brain waves, heart function, breathing, muscle activity and skin temperature (2). It provides a visible and experiential proof of the connection between the mind and body whilst it is a therapeutic tool for the self-regulatory learning of the autonomic nervous system that facilitates the functions for improving health (3). The basic and primary goal of biofeedback is to promote and support the acquisition of self-control of the individual in his or her normal functions (4), whereas Brown (5) argued that biofeedback is the process in which the individual learns to automatically control at will the reflexes of the physical functions he wants to regulate.

Anxiety management is one of the most fundamental health issues which is being faced by humans today and it has even been described as a silent killer (6). Increased anxiety, according to studies, has been associated with severe mental and physical pathologies such as the risk of developing schizophrenia and bipolar disorder (7) or even eating disorders due to anxiety (8). Anxiety disorders are assessed to be the most widespread mental illnesses in developed countries, occurring in the population with high incidence in chronic disorders (9). Biofeedback, as a method of neurophysiology, has been added to the methods recommended for the control and the management of anxiety.

2. AIM

The purpose of this study was to measure the effectiveness of biofeedback in the treatment of anxiety disorders, and in particular the contribution of the biofeedback method by using Brain Boy Universal Professional. The goal was to work more closely with the method and to discover

the effect of its application on humans whilst estimating the rate at which the individual is helped.

3. METHODS

The sample consisted of 50 individuals who presented themselves to a private practice where biofeedback has been practiced for the last thirty years with the request to receive help in order to relieve their symptoms of anxiety. For the purposes of this study, the self-administered questionnaire Hamilton Rating Scale for Anxiety (HAM-A) and a questionnaire with demographics were completed by the individuals before the initiation of the therapy (pre-treatment). The HAM-A questionnaire was again completed for a second time after individuals had completed ten sessions of treatment with biofeedback. The sessions were held once a week. Participants under the age of 18 were excluded from the study. The application of the Brain Boy Universal, with which the research was conducted, is a small medical biofeedback engine that includes eight exercises on each of its nine levels in which the person is actively involved. The exercises are based on the senses of hearing and vision and during the session, the person is asked to respond to acoustic and visual stimuli. In the first session and having completed each exercise twice, the first time at the norm level and the second time at the test level, data on the response was given to the individual. To be more specific, it reports the shortest and longest response time, the number of stimuli received and the percentage responded correctly. Most importantly, there is a discrepancy in every exercise between the right and left brain hemispheres which is important as the specific goal is to ensure a balanced brain function with the smallest possible deviation between the two brain hemispheres and the highest possible success rate in identifying acoustic and visual stimuli. Finally, it suggests the level of difficulty from which the individual can begin training to progress gradually, seeking to achieve the highest level of difficulty in exercises, which is level nine. Having now reached the last level and after managing to complete each exercise, ensuring a high percentage of stimulus recognition and as little difference as possible between the two brain hemispheres, the program is considered to have been completed. Subsequently, individuals may seek additional sessions when they think that they have lost their balance, according to their perception.

Data analysis: The data obtained from the demographic questionnaire and the Hamilton Rating Scale for Anxiety (HAM-A) were analyzed during the first and second completion of the questionnaire, followed by a comparison between the results. Categorical variables are presented as absolute (n) and relative (%) frequencies, while quantitative variables are presented as mean and standard deviation. The Kosmogorov-Smirnov test and the regularity charts were used to control the normal distribution of quantitative variables. Quantitative variables were found to follow normal distribution. The Students' t-test was used to investigate the relationship between a quantitative variable and a categorical variable, while analysis of the relationship between a quantitative variable with >2 categories was investigated by analysis of variance. The Spearman's correlation coefficient was used to investigate the relationship between two variables. In case where >2 independent variables were statistically significant at the level of 0.2 ($p < 0.2$) in the bivariate analysis, multivariate linear regression with a dependent variable was applied to the overall Hamilton score for stress measurement. In this case, the method of multiple linear regression with backward stepwise linear regression was applied. Regarding the multiple linear regression, coefficients' beta, corresponding 95% confidence intervals and p values were presented. The Cronbach's alpha internal consistency factor for all 14 Hamilton total scores for the anxiety measurement before biofeedback was 0.87, whereas after biofeedback was 0.86, indicating an excellent internal consistency of the questionnaire. The level of statistical significance was set at 0.05. Data analysis was carried out with IBM SPSS 21.0 (Statistical Package for Social Sciences).

Ethical considerations: The present research met all the ethical principles that govern the conduct of research such as full confidentiality of the participants, safety of the material and anonymity of the participants. Finally, the study protocol was in compliance with Helsinki Declaration and was approved by the University's Ethical Committee.

4. RESULTS

From the total sample of 50 individuals, the 72% visited the private practice for the management of anxiety / stress / work stress / pre-test anxiety / feelings, the 32% to deal with depression / sadness / melancholy / lack of joy, mood, energy / frost emotions, and the 14% to treat lack of memory / concentration. 70% of the sample had previously tried to resolve their problem using other methods of treatment such as psychotherapy, psychiatric treatment or counseling (40%), whereas others used methods such as homeopathy, acupuncture or alternative therapies (32%), and medication (12%).

Prior to biofeedback, 26% of the participants showed mild to moderate anxiety, 12% indicated a medium severity of anxiety and the remaining 62% experienced severe anxiety (Table 1). After the completion of 10 sessions of biofeedback, 78% of the participants were found to experience mild to moderate anxiety, 12% medium severity of anxiety and only 10% severe anxiety (Table 1).

Table 2 shows the interchangeable correlations between the overall Hamilton score for the measurement of anxiety and the independent variables of the study (sex, age, marital status, educational level, employment, previous attempts to confront the problem, taking medication for the problem or taking homeopathic medicines). At the statistical significance level of 0.05, there was no statistical

Severity Grade of Anxiety (Total score achieved)	Prior to Biofeedback N (%)	After the completion of Biofeedback N (%)
Mild to Moderate Anxiety (0-17)	13 (26,0)	39 (78,0)
Medium Anxiety (18-24)	6 (12,0)	6 (12,0)
Severe Anxiety (25-56)	31 (62,0)	5 (10,0)

Table 1. Overall score distribution in the three anxiety grades of Hamilton scale for measuring anxiety both before biofeedback and after the completion of 10 biofeedback sessions.

Demographic characteristics	**Average overall score on the Hamilton scale for anxiety (standard deviation)**	p-value
Sex		**0,048**[α]
Man	22,9 (11,1)	
Woman	30,2 (11,1)	
Age[β]	0,107[β]	0,460[β]
Marital status		0,944[α]
Unmarried	28,0 (13,0)	
Other	28,3 (10,4)	
Educational level[β]	-0,011[β]	0,942[β]
Position of employment		0,721[γ]
State employee	25,5 (9,4)	
Private employee	29,3 (9,8)	
Freelance	25,2 (12,3)	
Retired	32,4 (12,2)	
Other (student unemployed, domestic)	28,6 (12,3)	
Previous attempts to tackle the problem		**0,074**[α]
No	24,1 (9,3)	
Yes	29,9 (12,0)	
Taking medicines for the problem		**0,196**[α]
No	26,8 (11,5)	
Yes	31,4 (11,1)	
Taking homeopathic medicines[δ]		0,564[ε]
No	25,0 (31,0)	
Yes	29,5 (19,0)	

Table 2. Correlations between demographic characteristics and the average overall Hamilton score for anxiety measurement by using biofeedback.

significance between the overall Hamilton score and age (p = 0.460), marital status (p = 0.944), educational level (p = 0.942), employment (p = 0.721), previous attempts to tackle the problem (0,074), taking medicines for the problem (0,196) and taking homeopathic medicines (0,564) with the exception of gender (p = 0.048). After multivariate linear regression, women showed a higher overall Hamilton score in anxiety than men (p = 0.048).

The results of the bivariate analysis (Table 3) showed that the 87.1% of the participants with severe anxiety were women (p = 0.011). The median overall Hamilton scores for anxiety before and after biofeedback, is statistically significant (<0.001), with the Hamilton median overall score for anxiety being reduced by 19 units after biofeedback compared to before the initiation of biofeedback treatment (Table 4).

Demographic Characteristics	Severity of anxiety			
	Mild to Moderate	Medium	Severe	p-value
Sex				**0,011**[α]
Man	7 (53,8)	3 (50,0)	4 (12,9)	
Woman	6 (46,2)	3 (50,0)	27 (87,1)	
Age				0,098[β]
18-24	3 (23,1)	1 (16,7)	1 (3,2)	
25-34	3 (23,1)	1 (16,7)	9 (29,0)	
35-44	5 (38,5)	2 (33,3)	7 (22,6)	
45-54	1 (7,7)	0 (0,0)	8 (25,8)	
55-64	1 (7,7)	1 (16,7)	6 (19,4)	
>=65	0 (0,0)	1 (16,7)	0 (0,0)	
Marital status				0,714[α]
Unmarried	7 (53,8)	2 (33,3)	13 (41,9)	
Married	5 (38,5)	4 (66,7)	16 (51,6)	
Divorced	1 (7,7)	0 (0,0)	0 (0,0)	
Widower	0 (0,0)	0 (0,0)	1 (3,2)	
Separated	0 (0,0)	0 (0,0)	1 (3,2)	
Educational level				0,726[β]
Basic education	0 (0,0)	1 (16,7)	0 (0,0)	
High School	3 (23,1)	4 (66,7)	12 (38,7)	
Post-High School Education	1 (7,7)	0 (0,0)	4 (12,9)	
University	8 (61,5)	1 (16,7)	11 (35,5)	
Postgraduate	1 (7,7)	0 (0,0)	3 (9,7)	
Doctorate	0 (0,0)	0 (0,0)	1 (3,2)	
Position of Employment				0,928[α]
State employee	1 (7,7)	0 (0,0)	3 (9,7)	
Private employee	2 (15,4)	1 (16,7)	9 (29,0)	
Freelance	5 (38,5)	2 (33,3)	6 (19,4)	
Retired	1 (7,7)	1 (16,7)	5 (16,1)	
Other (student unemployed, domestic)	4 (30,8)	2 (33,3)	8 (25,8)	
Previous attempts to tackle the problem				0,318[α]
No	6 (46,2)	2 (33,3)	7 (22,6)	
Yes	7 (53,8)	4 (66,7)	24 (77,4)	
Taking medicines for the problem				0,285[α]
No	11 (84,6)	3 (50,0)	21 (67,7)	
Yes	2 (15,4)	3 (50,0)	10 (32,3)	
Taking homeopathic medicines				0,355[α]
No	3 (23,1)	0 (0,0)	3 (9,7)	
Yes	10 (76,9)	6 (100,0)	28 (90,3)	

Table 3. Bivarient correlations between demographic characteristics and the severity of anxiety.

	Median Overall Score on the Hamilton Scale for anxiety (min value, maximum value)	p-value
Before biofeedback	29,5 (8, 50)	<0,001*
After biofeedback	10,5 (2, 36)	

Table 4. Change in the median overall score on the Hamilton scale for anxiety after biofeedback.. * Signed rank Wilcoxon test

5. DISCUSSION

The present research is characterized by originality, since none of the studies found in the literature related to the treatment of stress and anxiety with biofeedback had used the biofeedback method of Brain Boy Universal Professional. Thus, the biofeedback method of the Brain Boy used in the present study may awaken the interest of other scientists in the field to conduct similar research studies to reveal the importance of this method for the treatment of not only anxiety disorders but also to other psychiatric disorders.

Taking into account the results of the study, the contribution of the Biofeedback Brain Boy Universal Professional to the management of anxiety and symptoms reduction is important. Individuals can undergo this treatment alongside other therapies of classical medicine or alternatives, with psychotherapy or even for prevention before the occurrence of the symptoms of anxiety.

Wells et al (10) in a randomized, controlled study, reported the effect of a single 30 minute session with the HRV biofeedback method on 46 musicians in response to anxiety which can occur during their musical performance. The results showed that a single slow-breathing period is enough to reduce anxiety before the psychosocial stress associated with musical performance had occurred. Thus, the results were extremely optimistic as music performance is a specialized activity that takes place under intense pressure.

Panayotopoulou & Paschali, (11) conducted a study with twelve Malaysian students using a biofeedback program to reduce the anxiety caused when studying. The program included the learning of biofeedback relaxation techniques to control and reduce physical stimulation by applying diaphragm breathing, relaxation and study techniques. The results showed a statistically significant reduction in anxiety and an increase in academic performance compared to the control group.

In a systematic review conducted to rehabilitate individuals, suffering from psychiatric disorders who were receiving medication, by using EEG biofeedback, the results showed that treatment with biofeedback positively affects cognitive processes, mood, and anxiety levels. Thus, the application of EEG biofeedback, whether used as a primary or ancillary method, confirmed its positive effects and usefulness. Among the mental disorders which were clinically diagnosed and analyzed in this systematic review, included depression, anorexia, dyslexia, schizophrenia, substance abuse, post-traumatic disorder anxiety, attention deficit hyperactivity syndrome, and Alzheimer's disease (12).

In another study, biofeedback was applied to reduce the symptoms of stress, anxiety and depression in sixty postgraduate students at a large public university in Thailand. The results showed that biofeedback was effective in reducing stress, anxiety and depression, whereas the control group showed increased levels of anxiety and depression. The sixty participants had a university degree and were enrolled in one of the postgraduate programs at the Public Health School. The age range of the participants was between 21 and 52 (M = 34.05, SD = 7.61). 96% of participants were women and 4% men, and their average grade (GPA) was between 3.00 and 4.00 (M = 3.56, SD = 0.25). Among the participants, 45% were first year postgraduate students, 22% were second year, 17% third year, 10% fourth year and 7% fifth year. The results of this study confirmed that biofeedback reduces stress and anxiety while it expanded to include the significant effect of biofeedback on depression (13).

Biofeedback was also applied to children receiving dental care in order to manage their anxiety. Extremely restless children were trained using biofeedback in five sessions with each session lasting forty-five minutes. After the initial education about the biofeedback, children were randomly divided into two groups and therapeutic rehabilitation took place in four consecutive sessions, each session one week apart, with a 3 months follow-up. The results showed that biofeedback treatment led to lower levels of anxiety in initial meetings according to the objective evaluation while the subjective evaluation methods did not represent a statistically significant difference. However, biofeedback can be used in restless children during the first therapeutic encounters, whereas in this case, it was proposed to use simpler biofeedback machines (14).

In a study with eighteen children aged five to fifteen-year-old who faced a problem of attention deficit disorder, some of whom also faced with learning difficulties, underwent EEG biofeedback over a period of six months, in forty sessions that lasted forty-five minutes each, in order to enhance beta activity and suppress theta activity. No other psychological treatment or drug was given to the children, whereas all individuals were measured before and after biofeedback application by using an IQ assay. At post-treatment, the EEG biofeedback group showed a significant increase (mean 9 points) in K-Bit IQ Composite compared to control group ($p < 0.05$). Additionally, inattentive behavior was assessed, as rated by parents, which was significantly reduced ($p < 0.05$) (15).

Pazooki et al (16) showed the contribution of the biofeedback electroencephalographic method (electroencephalography–EEG) in two individuals with negative schizophrenia symptoms who were under antipsychotic medications who did not respond reliably. The two individuals were a woman aged forty-five and a thirty-year-old man who underwent twenty sessions of biofeedback. After the completion of the sessions, GAF scores improved and the individuals no longer met the diagnostic criteria of negative symptomatology. This reduction in symptoms also helped them to increase social, interpersonal and cognitive abilities, while the results suggested that EEG methodology should be considered on a larger scale as it is a promising alternative to therapeutic approaches to the negative schizophrenia symptoms.

In pregnant women, the biofeedback application of the Heart Rate Variability (HRV) was applied to help them cope with their variability of their heart rate. The study included

seven pregnant women who had volunteered to participate upon the midwives' invitation. Five completed all sessions lasting 45 to 50 minutes. Their training included reading books, being taught how to use emotion-focused management techniques, and HRV biofeedback. The women were given portable biofeedback devices to apply the method during particularly stressful periods as well as on a daily basis for 20 minutes at a time. The results showed improvement in autonomic performance while five women stated they were able to cope with stress compared to before the initiation of the study, and they had used management skills during their work and will continue to do so in their everyday life (17).

In a study conducted at a multispecialty hospital with 100 participants diagnosed with a psychiatric disorder, were divided into two treatment groups and evaluated by using both the Hamilton scale and the Taylor anxiety scale. From the total sample, 50 patients were treated with Alpha EEG Biofeedback for eight weeks five times weekly together with a specific pharmacotherapy while the other group was treated with appropriate doses of anxiolytic drugs. The two groups were re-examined after four weeks and after eight weeks, and the results showed a positive response in cases of mixed anxiety and depressive disorder with pharmacotherapy than that of biofeedback, but women responded better to EEG biofeedback therapy. In conclusion, we conclude that Alfa Wave EEG therapy, in the short term, is as effective as pharmacotherapy in the management of anxiety symptoms especially in women (18).

6. CONCLUSION

From the present study, the biofeedback method of Brain Boy contributes to the treatment of anxiety disorders in a completely natural way, giving treatment to patients who do not respond to drugs but also to those who want to undergo such treatment alongside other methods. In the future, it is proposed to repeat the study by using other groups of individuals such as children and patients with a variety of neurobiological diseases.

- **Author's contribution:** Each author gave substantial contributions to the conception or design of the work in acquisition, analysis, or interpretation of data for the work. Each author had a part in article preparing for drafting or revising it critically for important intellectual content, and each author gave final approval of the version to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.
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