

The Effect of Biofeedback Electromyography (EMG & EEG) Training on the Tension and Migraine Headaches of Migraine Patients

Farah Naderi, Mahsa Jorjorzadeh *

Department of Psychology, Khuzestan Science and Research Branch, Islamic Azad University, Ahvaz, Iran

Abstract This study aimed at studying the effect of electromyography biofeedback (EMG & EEG) training on the tension and migraine headaches of migraine patients in Ahvaz. The sample of the study included 30 participants who were selected through simple random sampling, and were assigned to experimental and control groups. The research design was pre-test, post-test with a control group. The participants were pre-tested using the scales of tension headache (HIS) and migraine headache. The experimental group underwent a biofeedback EMG and EEG treatment for twenty 45-minute sessions (in two months). Then, after the treatment both groups were post-tested. To analyze the data, a multivariate analysis of covariance (MANCOVA) was conducted. Results showed a significant difference between the experimental and control group, that is, electromyography biofeedback reduced the tension and migraine headaches.

Keywords Biofeedback, Migraine, Tension headache

1. Introduction

Headache has emerged as one of the rampant complaints of contemporary humans. 90 percent of people get headaches at least once a year (Modara & Rostamkhani, 2008). Headache is the most rampant syndrome of pain which can be considered as the most frequent symptom in neurotic illnesses. Headache alone can be realized as an illness or it can be an indication of a systemic or local illness. Migraine is periodic and repetitive headache which is usually accompanied by vomiting and nausea, and is divided into two categories with or without aura. Migraine headache is diagnosed when at least five headache attacks have occurred in a 4-72 hours (Ziaei & Shirzadi, 2002). Based on the categorization of the special committee of world health institutes, headaches resulting from the short cranium muscles is called tension headache which sometimes occurs in tension situations, and its persistence results in depression and is more rampant than migraine (Bonica, Lose, & Chapman, 1990).

Migraine patients usually suffer from tension headaches in addition to migraine headaches (Silberstein, Lipton, & Goadsby, 1998 cited in Gozke, Erdal and Özkarakas, 2010). Unfortunately, so far no complete and absolute cure has been identified for the symptoms resulting from headaches.

Migraine patients are usually resistant to pain relieving drugs, and consuming common drugs which are prescribed for these patients is usually useless. Therefore, patients suffering from headaches are forced to constantly use large doses of sedative and pain relieving drugs to reduce their pains, which in the long run, can have dangerous side effects for the consumers of the drugs. Due to the negative effect on the individual's quality of life, reducing his efficiency, and disturbing his free time activities, tension and migraine headaches are two problems of the current era (Posner, 1996; Raskin, 1998).

In this regard, experts always use extensive therapy methods to treat these patients. From drug therapies like Ergotamine, triptans, pain killers, and anti-depression drugs to non-drug therapies like relaxation, acupuncture, and biofeedback (Sadock & Sadock, 2003). But recently, studies have shown that applying biofeedback causes reduction in migraine headaches of these patients (Walker, 2011). Meanwhile, the likely existence of other concurrent disorders in migraine patients requires that the treatment process in these patients be pursued more extensively. Given the significant effectiveness of the continuum of various biofeedback methods in migraine headaches, studying the effectiveness of this new treatment method, especially tension headache, will have importance and very useful achievements for experts, therapists, and patients.

Biofeedback can be an appropriate therapy method in migraine patients. Biofeedback is a scientific treatment approach which is dependent on instrument for a moment to moment physical activities related to the problems of areas

* Corresponding author:

talaezadeh.mahin@gmail.com (Mahsa Jorjorzadeh)

Published online at <http://journal.sapub.org/ijap>

Copyright © 2015 Scientific & Academic Publishing. All Rights Reserved

which suffer vulnerability. The theoretical underpinning of this machine is based on the idea that automatic nerve system can undergo voluntary control through agent conditioning. Biofeedback is process which uses some tools to show, assess and reinforce the internal physiologic responses to provide the person with feedbacks from these responses (Yung, Yung, & Myung, 2012).

Therefore, the need of the migraine community for more effective therapeutic methods with less side effects than conventional therapies, underscores the necessity of conducting this study.

2. Methodology

The present study is a cross sectional and quasi experimental study in which the data for all the patients who referred to specialized clinics and centers in Ahvaz from November of 2014 to January 2015 were analyzed first. 30 patients (28 female, 2 males) were selected as the sample through random sampling and according to the HIT6 (Headache Impact Test) and MS-Q (Migraine Screen Questionnaire) scales for tension headache and migraine headache respectively. First in the pretest, all the patients filled in the list of migraine headache and tension headache. Then, the patients in the experimental group received training in and treatment with the interactive biofeedback EMG and EEG for 20 sessions (two sessions of training and 18 sessions of therapy) once a week, while the patients in the control group didn't receive biofeedback treatment. Then all the participants took part in the post test and completed the questionnaires. Due to the duration of the study, and to prevent the harms resulting from headache, the control group underwent a drug therapy under the supervision of a psychiatrist. This was done to observe the ethical considerations to treat the control group. The criteria for entering the study were: 1- suffering from migraine headache 2- having the history of tension headache with the frequency of at least once a month 3- The headache has not been due to organ or acute psychiatric diseases. 4- For the experimental group, the continuation of the therapy and the completion of the 20 sessions which would last at least two months, and 5- the patients' consent for participating in the study.

3. The Data Collection Instruments

3.1. The Diagnostic Questionnaire for Tension Headaches HIT-6

To determine and diagnose the tension headache attacks and the frequency of the tension headache attacks, the duration of the tension headache attack (hour), and the severity of the tension headache, a researcher made scale based on the criteria from International criteria for Headache Disease (ICDH) were used which has four criteria (0= none, slight= 1, moderate= 2, and severe=3). To do so, before

starting the therapy, first the maximum point of severity, duration, and the frequency of headache attacks are determined. The internal consistency of this scale on 274 patients with definite diagnosis of migraine and tension headache was 0.74, 0.77, and 0.73 among all the patients, migraine patients, and tension headache patients, respectively. The test retest reliability of the scale between the first and second treatment session showed a moderate level of consistency (0.50). In addition, the convergent validity of this questionnaire in acute tension headaches, periodic and chronic migraine was 24.5, 0.61, and 13.6 respectively. Also the study of the convergent validity showed that there is no significant difference between the overall scores of HIT-6 and TTH and migraine (Zandifar et. al., 2013). The Cronbach alpha obtained for the present study was 0.76.

3.2. The Migraine Attacks Questionnaire

In Iran, this questionnaire which is adapted from its foreign version (MS-Q) was written by Zandifar et. al. (2013). To write the questionnaire, 58 questions about the physical and mental symptoms of migraine headache were first written based on the medical and psychological texts. After the statistical analysis, 25 questions were chosen from all the questions. To study the reliability of the questionnaire, the test retest method was used, and the test retest coefficient was 0.80 for all the participants, 0.47 for female participants, and 0.75 for male participants. To evaluate the internal consistency of the questionnaire, Cronbach alpha was calculated, which was 0.91 for all the participants, 0.81 for female participants, and 0.89 for male participants. In addition, to study the convergent validity, this questionnaire was administered together with the Hospital Anxiety and Depression Scale (HADS) and the MMPI questionnaire and the aggression questionnaire in Ahvaz, which showed the validity of this questionnaire (Zandifar et. al, 2013). The Cronbach alpha of this questionnaire in the present study was 0.88.

The research method was quasi experimental. The results of the analysis of the equality of the regression line slope of the tension headache variable and the migraine headache as the presumption of the covariance analysis were indications of the homogeneity of the regression line slope. The normality of the variable distribution was studied through the Shapiro-wilk's test and variance equality through Levene's test. In the present study the pretest posttest with equivalent control group method was used, and the data analysis was conducted using multi and univariate analysis of covariance with the SPSS software (version 18) for windows. The significance level was set at 0.05.

4. Findings

The statistical description of the pre and post test scores for "tension headache" and "migraine headache" of migraine patients are provided in Table 1. According to the inserted

results, the mean for the scores of the tension headache pretest is 26.65 in the experimental group and 25.6 in the control group. Also the mean score in the post test was 17.01 for the experimental group, and 27.13 for the control group. For the frequency of migraine headache variable, the mean score of this variable in the pretest was 35.53 for the experimental group and 34.43 for the control group. In addition, the mean score of the post test was 25.84 in the experimental group and 33.65 in the control group.

To determine the effectiveness of the interactive biofeedback therapy (EMG and EEG) on the tension headache and migraine headache of migraine patients, given

the observation of all the assumptions of the variance analysis (the equality of the regression slope, homogeneity of the variances and normal distribution), this test was used. The results of the multivariate covariance test shows that experimental intervention has been effective in at least one kind of the of the tension and migraine headaches. Table 3 illustrates the results of the univariate analysis of covariance on the means of tension and migraine headaches separately.

As can be seen from the results of the univariate analysis of covariance, findings indicate that interactive biofeedback therapy (EMG and EEG) has been effective on the tension and migraine headache of the migraine patients ($p < 0.05$).

Table 1. The description of the pre and post test scores of “tension headache” and “migraine headache” according to groups

Statistical indices					
frequency	Standard deviations	mean	← group	stage	variable
15	6/58	26/65	experimental	pretest	Tension headache
15	3/60	25/06	control		
15	7/88	17/01	experimental	posttest	
15	6/11	27/13	control		
15	6/29	35/53	experimental	pretest	Migraine headache
15	3/45	34/43	control		
15	8/55	25/84	experimental	Posttest	
15	6/14	33/65	control		

Table 2. The multivariate analysis of covariance on the mean of the post test of the experimental and control groups in tension and migraine headaches

Effect size	Significance level	degrees of freedom of error	degrees of freedom of the Hypothesis	F ratio	value	Test title
0/645	0/002	15	4	6/803	0/645	Pilliai effect test
0/645	0/002	15	4	6/803	0/355	Wilk's Lambda test
0/645	0/002	15	4	6/803	1/814	Hoteling effect test
0/645	0/002	15	4	6/803	1/814	The greatest root effect on

Table 3. The results of the analysis of covariance of the modified mean differences of the tension and migraine headaches of migraine patients in the experimental and control groups

Effect size	Significance level	F	Mean of squares	Degree of freedom	Sum of squares	Source of variability	variable
0/060	0/261	1/337	65/490	1	65/490	pretest	Tension headache
0/273	0/010	7/900	386/977	1	386/977	Groups(independent)	
			48/982	21	1028/616	Error variance	
0/021	0/510	/448	25/467	1	25/467	pretest	Migraine headache
0/243	0/017	6/737	382/839	1	382/839	Groups (independent)	
			56/822	21	1193/270	Error variance	

5. Discussion

To conduct this study the interactive biofeedback method (EEG and EMG) was used. After the statistical analysis it became clear that this method has been effective on both kinds of tension and migraine headache of the patients, and the 64 percent improvement of the tension and migraine headaches of the migraine patients after the interactive biofeedback therapy period is an indication of the effectiveness of this therapeutic method.

In line with the results of the present study, Nestoriuc, Martin, Rief, and Andrasik, (2008) and Grazzi, Andrasik, D'Amico, Leone, Moschiano and Bussone (2001) can be mentioned. Tension headaches are accompanied by extreme tension in the face, neck and the loin's upper muscles (Bakhshayesh, 2010). The therapy schedule set for reducing perceived stress in the present study was as follows: using biofeedback (EMG) during 10 sessions, sensors were placed in some areas of forehead, face, and eyebrows, and the amount of the tension in these areas was registered using the drawn diagrams by this machine. After interpreting and becoming aware of the amounts of tension in these areas of the patient, the patient was trained in breathing exercises and advancing relaxation during the therapy sessions. Also in the present study, given the migraine suffering of the patients, and their high degree of tension headache, biofeedback (EEG), too, was applied in 10 sessions together with biofeedback (EMG), and with feedback and awareness of tension inducing brain waves to the patient, the patients were trained in strengthening the brain waves with slow ranges. As a result it can be said that the treatment package set based on the concurrent application of Electromyography and Electroencephalography biofeedback, and the arranged sessions for the migraine patients in this study has been able to reduce the degree of the tension headache of these patients.

Overall, it can be said that with awareness and training the individual in the functions and symptoms of malfunctioning of some of the brain areas and waves biofeedback plays an effective role in reducing the tensions especially tension headaches with the opportunity of learning or relearning of brain and bio self-regulation mechanisms (Grohol, 2007; Bakhshayesh, 2010). According to the result of the hypothesis, one can refer to Nestoriuc et al (2008) who showed that the results of the meta-analysis study of biofeedback for tension headache has a large effect size. In other words electromyography biofeedback for the tension headache has more significant effects than relaxation and placebo therapy and Grazzi et al. (2001) showed that biofeedback electromyography has considerably improved the degree of the tension headaches. Through meta-analysis, White (2007) showed that behavioral interventions like biofeedback has been effective in reducing the tension headache from 35 to 50 percent.

In addition to the effectiveness of combined biofeedback (EEG and EMG) on tension headache, other results of the present study showed that this intervention has caused a

significant decrease in migraine headache, too. These results are in line with Stokes and Lappin (2010), Marcos et al (2010), and Labaf and Akrami (2011).

Overall it can be said that with muscular relaxation and separation of tension creating emotional states, training in biofeedback teaches the patients to evaluate the conditions at any moment and in a self-regulated manner put his body system on a relaxed state, and through setting the brain wave activities especially alpha rays cause a reduction in the severity and degree of migraine headaches.

Like other studies, the present study has some limitations, namely lack of a concentrated location of the study, the spread of the neurotics and psychiatric clinics in the city of Ahvaz, and the restricted number of experts in biofeedback therapy have slowed the study and were among the basic limitations of this study. In addition, the limited number of male participants due to the overlap of the working hours with the treatment, and the number of the sessions and their relative length (at least two months) are considered as the limitations of the present study.

6. Conclusions

According to the results of the present study, interactive biofeedback (EEG and EMG) is an effective method with very limited side effects and considerable therapeutic effect for treating tension and migraine headaches in migraine patients. Therefore, given the therapeutic advantages of biofeedback, especially concurrent application of biofeedback (EEG and EMG), it is necessary that in future further research and with long term follow up studies (follow up studies after the treatment) be conducted on this therapeutic method.

REFERENCES

- [1] Bakhshayesh, A. (2010). Biofeedback. Yazd University Publications: first edition
- [2] Bonica, J., Loser, J., Chapman, R. (1990). *The management of Pain*. New York, Lead Febiyar, PP 711-716.
- [3] Gozke, Eren; Erdal, Nursel and Özkarakas, Haluk (2010). Ocular vestibular evoked myogenic potentials in patients with migraine. *Acta Neurol. Belg*, 110, 321-324.
- [4] Grazzi L, Andrasik F, D'Amico D, Leone M, Moschiano F, Bussone G. (2001). *Electromyographic biofeedback-assisted relaxation training in juvenile episodic tension-type headache: clinical outcome at three-year follow-up*. *Cephalalgia*. 2001 Oct;21(8):798-803.PMID:11737004[PubMed - indexed for MEDLINE]
- [5] Grohol, J. (2007). *Neurofeedback Training for Your Brain*. *Psych Central*. Retrieved on September 22, 2014, from <http://psychcentral.com/lib/neurofeedback-training-for-your-brain/0001239>
- [6] Jung, K.W., Yang D. H., Myung, S. J. (2012). *Biofeedback*

Therapy. Encyclopedia of Human Behavior (Second Edition).
Pages 344- 347

Biofeedback. 2008 Sep;33(3):125-40. [Http:// doi:
10.1007/s10484-008-9060-3](http://doi.org/10.1007/s10484-008-9060-3).

- [7] Labaf, N., & Akrami, N. (2011). The study and comparison of brain-behavior system of migraine patients and healthy people. The fourth international conference on the pshycosomatic of the Islamic Azad University Khorasgan branch (Isfahan).
- [8] Marcus, D.A., Scharff, L., Mercer, S., & Turk, D.C. (2010). *Nonpharmacological treatment for migraine: incremental utility of physical therapy with relaxation and thermal biofeedback*. *Cephalalgia*, 18(5):266-272.
- [9] Modara F, Rostamkhani M. (2008). *Prevalence of tention and migraine headaches among the students of Ilam Medical University*. *Journal of Ilam University of Medical Sciences*. 15 (4): 13-9.
- [10] Nestoriuc, Y., Martin, A., Rief, W., Andrasik, F. (2008). *Biofeedback treatment for headache disorders: a comprehensive efficacy review*. *Appl Psychophysiol*
- [11] Posnecr, J. (1996). *Disorders of sensation*. In: *Bennet, J., Plum, F. (Eds). CeCil textbook of medicine*. Vo II, 20th ed., Phiadelphia, W. B. saunders CO. PP 2014-2030
- [12] Raskin, N. H. (1998). *Headache*. 2nd ed. New York (NY): Churchill Livingstone.
- [13] Sadock, B, Sadock V. (2003). *Psychiatric summarize behavioral science-clinical psychiatry* .
- [14] Stokes, Deborah A, Lappin, Martha S (2010). *Neurofeedback and biofeedback with 37migraineurs: a clinical outcome study*. *Behavioral and Brain Function*. 6. 9.
- [15] Walker, J. E. (2011). *QEEG-guided neurofeedback for recurrent migraine headaches*. *Clinical EEG and Neuroscience*, 42(1), 59–61.
- [16] Zeiaee J, Shirzadi M. (2002). *Neurological diseases*. 1st ed. Isfahan: Kankash.