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The effectiveness of hemoencephalography (HEG) on pain anxiety and pain intensity among migraine patients aged 25-55 in Isfahan city

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Abstract

Introduction: The presented paper was conducted in order to examine the effectiveness of Hemoencephalography (HEG) on pain anxiety and intensity among migraine patients aged 25-55 in Isfahan.

Materials and Methods: This clinical study research conducted with a control group and one-month follow-up period. The research population included all patients with migraine aged 25-55 years old who referred to treatment centers referred to neurologists' and psychiatrists' clinics in Isfahan in the fall of 2015. The accessible sampling method was adopted in a way that 30 migraine patents were selected and they were assigned to experimental (15 participants) and control group (15 participants) according to inclusion and exclusion criteria. The subjects answered the pain anxiety inventory and pain intensity inventory before and after the intervention. The experimental group was exposed to Hemoencephalography treatments while the control group received no intervention at all.

Results: Variance analysis results based on repeated measurements showed that the difference in pain anxiety and pain intensity experienced by the experimental and control groups was significant (P<0.05).

Conclusion: According to the research findings, hemoencephalography can be used as a beneficial method for treatment of pain anxiety and pain intensity among migraine patients.

Keywords: Hemoencephalography, Migraine, Pain anxiety, Pain intensity

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Introduction

Migraine is one of the chronic neurological disorders that is defined by repeated attacks of headache and accompanied by symptoms such as nausea, and sensitivity to light and sound that last for 4-72 hours. Today, headache is one of the problems of approximately 40% of people in England and one of the common reasons for consulting doctors (1). Compared to non-migraine sufferers, people with migraines are almost twice as prone to migraine attacks, and these attacks are also related to seasonal allergies, asthma, epilepsy, constant nightmares, stroke and heart attack, and sleep problems. Therefore, headache is one of the most important pains that we face today. Based on this, the International

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Association for the Study of Pain defines pain as follows: an unpleasant sensory and psychological experience that is related to possible or actual tissue damage or occurs during periods of such tissue damage (2).

Classification of the International Headache Society divides migraine into two categories with aura (classic migraine) and without aura. Aura is a reversible neurological disorder that may be in the form of numbness and tingling of the scalp or changes in the senses of hearing, vision, smell or speech.

The most common type of headache is migraine, which is usually unilateral and often has a throbbing quality. It is often accompanied by nausea, vomiting, phonophobia, photophobia, and lethargy, and more than half of patients show bad symptoms that affect mood, appetite, or cognition.

Visual auras or other neurological auras are seen in 15 to 20% of patients. Tension headache can be a continuous and usually bilateral feeling of pressure or stiffness, which can be in periodic and stress-related migraines, but can occur almost daily in a chronic form (3).

Intracranial vasoconstriction and extracranial vasodilation have long been known as the causes of aura phases and migraine headaches (4).

More recent studies of regional brain blood flow during migraine attacks have shown a decrease in regional brain blood flow that starts from the occipital region during the aura phase (3) inhibitory changes or other biochemical changes that remain unknown. It can in turn stimulate the nucleus of the trigeminal nerve. The presence of inhibitory or facilitating signals on the said nucleus can justify headache attacks. Therefore, reducing the inhibitory state aggravates the attacks of headaches. Environmental mechanisms have also been presented in relation to migraine (5).

Periodic migraine attacks cause dysfunction of the patient, including long-term absences from work, affect mood and sleep disorders (6).

Migraine sufferers get congestion more easily in response to serotonin than normal people. Platelets have the highest amount of serotonin in the blood, and at the beginning of a migraine attack, the concentration of serotonin in the plasma and then its metabolite in the aura increases. As a result, the level of serotonin is increased and serotonergic cycles are effective in regulating sleep cycles, feeling pain, regulating mood, which are also important factors in migraine syndrome (4).

A new area of research related to chronic pain is pain anxiety. Most studies have found that anxiety has an effect on pain. Although most research on pain and anxiety are focused on acute pains (7), researches suggest pain-related anxiety as one of the most important contributory variables in the creation and persistence of musculoskeletal pains (8). Pain anxiety is a predictor of pain behaviors during treatment (9). Although anxiety and fear of pain are used synonymously, they are very different in terms of meaning. The main difference between anxiety and fear is their duration. If the anxiety caused by pain is not treated, it will be revealed in the form of fear, sleep deprivation, depression and disability, and it will result in ineffective psychological coping and the patient's non-cooperation with treatments (10). The interaction of cognitive, emotional and pain intensity factors in predicting the disability of headache patients have been explained, among which the unique and important role of pain anxiety in the disability of headache patients is more prominent. Based on this, on the one hand, pain leads to negative emotions, and on the other hand, negative emotions, in turn, cause the continuation of pain. The effect of each on the other is one of the most important secrets of pain experience. Despite the moderate effectiveness of some biological and psychological treatments for pain, there is no complete and successful treatment for pain anxiety (2).

The International Association for the Study of Pain (1986) defines pain as an unpleasant sensory experience or emotion that is associated with actual or potential injury. Pain experience consists of two sensory and emotional dimensions. The sensory dimension of pain indicates the intensity of the pain and its emotional dimension indicates the level of dissatisfaction of the person with the pain experience. Following the failure of other treatments, the introduction of the three dimensions of pain by Melzak and Wall in the gate control theory, which considered the intensity and nature of pain as a function of sensory, cognitive and emotional mechanisms, in

many researches, the intensity of pain and physical injuries as Important predictors of disability have been proposed (11). The pain gate theory of the medical approach has combined the previous theories with recent biological, psychosocial health models (12), this approach is not only satisfied with medical factors, but also considers the interaction between biological, psychological and social factors. (12).

This theory proposes that there is a gate or, to be precise, a gate mechanism in the nervous system, which opens and closes in multiple responses. Excitement or anxiety have different effects on the gate. Some activities close the gate of pain and reduce the possibility of experiencing pain, and this is because rubbing the injured foot can relieve the pain (12) In migraine headaches, some activities, emotions and emotions cause the opening and closing of this gate and in The result has an effect on the severity of pain (13).

Currently, the use of non-pharmacological complementary and alternative medicine treatments, such as biofeedback, acupuncture, hypnosis, and relaxation, is very common in the treatment of psychosomatic diseases. Despite the tremendous advances in medical sciences, many people turn to other treatment methods such as homeopathy, energy therapy, meditation and other complementary and alternative medicine methods.

These treatment methods have reached today from ancient medical traditions or have been formed based on contemporary concepts (14). Hemoencephalography was first used by Tomim (1997) to describe its process, using infrared spectroscopy (15). Hemoencephalography is a method to indirectly measure the activity of neurons in the brain. It has two different types of near-infrared and passive infrared. These two systems react to the dynamics of blood flow as a source of data.

Carmen (16) near-infrared type measures the color difference in the light reflected from the skull (based on the relative amount of oxygenated and deoxygenated blood). The passive infrared type measures the heat radiated from the skull in different conditions. With the help of this method, brain activity can be regulated. Hemoencephalography is used in the treatment of anxiety, panic, depression, migraine, chronic fatigue and also to improve brain function (17). With a review of the past treatments, the void of definitive migraine treatment has not yet been filled and many people suffer from this disease and are looking for a treatment to reduce the pain. Basically, the neuropathology of migraine is unknown. Previous treatments have lasting effects only as long as they are used. However, according to the studies conducted on the effect of hemoencephalography on people suffering from migraine, due to the lack of side effects caused by this treatment and its durability over time and relative recovery, the patient shows more interest in this treatment. This method has the least influence from the surrounding environment and unlike neurofeedback treatment, it is not affected by artifacts and metals.

Existing drugs do not always provide complete or adequate pain relief to patients. This causes the dissatisfaction of the patients, and despite the significant pain and disability caused by it, they do not follow up their complete treatment and stop their treatment process due to their dissatisfaction with the drug treatment (18).

Therefore, considering the side effects of drugs, drug tolerance, non-response or insufficient response to drug treatment and the high costs of drug preparation, the necessity and importance of implementing non-drug methods in the form of non-drug and alternative treatments is already obvious.

The results of the present research can provide valuable help to the treatment methods of neurofeedback and biofeedback in clinical environments by doctors and other trained health care workers. In the clinical realm, if the effectiveness of using this technique is confirmed in reducing migraine headaches, it can be beneficial. Doctors can simultaneously use this method and this technique with its drug treatment and indirect costs (use of drugs) and indirect costs (minimizing the hours wasted in the individual's efficiency and increasing productivity and usefulness) and in the activity of expanding such methods, they can help many psycho-physical patients and have an effective contribution in increasing their quality of life.

Materials and Methods

The current research is a clinical trial with an experimental and control group and a one-month

follow-up period. After sampling, hemoencephalography treatment was performed on the experimental group during 15 sessions of 30 minutes, three sessions a week, and the control group did not receive any treatment during the research period. The training period lasted two months. The researcher also participated in periodic neurofeedback and biofeedback sessions before starting and obtained the relevant certificate, and the therapy sessions were conducted by the researcher himself. After the treatment and the follow-up period of one month, the post-test was performed on both groups.

The statistical population of this research includes all patients with migraine aged 25-55 who visited medical centers, neurologists and psychiatrists in Isfahan city in the fall of 2014. Due to the fact that 15 people have been recommended for intervention studies in two groups (19), therefore, the research sample was considered to include 30 people. In this research, sampling was available as a sample. 30 patients with migraine were randomly assigned to the experimental group (15 people) and the control group (15 people) according to the entry and exit criteria.

Research instruments

A) Pain Anxiety Scale (PASS): Pain Anxiety Symptom Scale is a self-report tool to assess anxiety and fear reactions related to pain in people with chronic pain, which was created by McCracken et al. in 1992. The pain anxiety questionnaire evaluates the symptoms of anxiety related to pain and includes 4 subscales of cognitive anxiety symptoms related to the experience of pain, escape and avoidance behavior related to pain reduction, fearful evaluation of pain and physiological anxiety symptoms related to pain (7).

The short form of this scale has 20 items and was created by McCracken and Dhingra in 2002 based on the original scale. Subjects must answer the questions of this scale in a range from zero (never) to six (always). The range of scores is between 0-100, with a higher score indicating greater anxiety. This scale has 81% internal reliability and 0.95 convergent and divergent validity. It also has good predictive validity and structure (20). Questions 1 to 5 are related to cognitive anxiety, and questions 6 to 10 are related to escape and avoidance behavior, and questions 11 to 15 are related to fearful evaluation of pain, and physiological symptoms are from questions 16 to 20. Each is collected separately. Also, Cronbach's alpha of this questionnaire in this research is equal to 0.94 (in cognitive dimensions 0.87, escape and avoidance behavior 0.83, fearful evaluation of pain 0.94, physiological anxiety symptoms 0.81).

B) McGill Pain Intensity Questionnaire (MPQ): The McGill Pain Questionnaire was created in 1997 by Melzak and has 20 sets of statements, and its purpose is to measure people's understanding of pain and different dimensions of pain. The questionnaire has been translated into Farsi using the standard method. The McGill short form questionnaire (15 questions) is in Persian for pain intensity with two subscales of two sensory and emotional dimensions. The method of implementation is paper-collective-self-reporting. The questions are scored on a 4-point Likert scale from no pain = 0 to severe = 3. (Three scores are obtained: sensory, emotional, general). The reliability and validity of the Persian version of the Short Pain Questionnaire, which has 15 items, has been evaluated by Parviz Vakilzadeh and Dr. Nozer Nakhai from Rafsanjan University of Medical Sciences. Internal consistency was confirmed through Cronbach's alpha coefficient and the item-scale correlation coefficient of exploratory and confirmatory factor analysis. Cronbach's alpha was 0.87 for the whole questionnaire and 0.87 and 0.89 for the dimensions of pain intensity and reaction, respectively.

A lower score indicates less pain intensity. In this questionnaire, the first 11 items are sensory and the next 4 are emotional, so it has a sensory score, an emotional score, and an overall score. Also, Cronbach's alpha of this questionnaire in this research is equal to 0.88 (0.84 in sensory and 0.81 in emotional dimensions).

Results

Descriptive indices of research variables according to evaluation stage and group membership are presented in Table 1.

Table 1. Descriptive indices of the scores of the research variables, separated into two groups and three stages of the research

		Experimental group			Control group		
Variables Group		pretest	posttest	Follow-up	Pre test	Post test	Follow-up
Pain Anxiety	Mean	3.099	26.2	2.54	5.53	5.93	0.9558
	Standard deviation	1.899	1.913	1.642	2.593	2.013	2.26
Pain Intensity	Mean	20.2	1.814	1.275	27.3	2.066	2.26
	Standard deviation	6.51	5.86	6.58	8.4	8.6	0.168

As can be seen in Table 1, the average scores in all research variables in the post-test and follow-up phase in the experimental group improved more than the control group.

The results of analysis of variance with repeated measures regarding pain anxiety are presented in Table 2.

Table 2. The results of variance analysis with repeated measurements regarding pain anxiety in pre-test, post-test and follow-up

Degree of freedom	Mean Square	F	Significance	Effect Size	Statistical Power
1.234	545.361	16.781	0.001	0.411	0.99
1	14842.272	11.846	0.002	0.33	0.95
1.234	448.118	13.789	0.001	0.365	0.972

Based on the findings in Table 2, the difference between pain anxiety scores in the three stages of the research is significant (*P*= 0.001). Also, the mean scores of this variable in the two experimental and control groups also have a significant difference (*P*= 0.002). The results have shown that nearly 33% of the individual differences are related to the differences between the two groups. In addition, the interaction between research stages and group membership is also significant (*P*= 0.001). In other words, the difference between pain anxiety scores in three stages of the research in two groups is significant. The amount of these differences is around 0.365, which means that 36.5% of the variance or individual differences are related to the differences between the three stages of the test and group membership. Hemoencephalography has reduced pain anxiety in patients with migraine.

A column chart comparing the average scores of pain anxiety in the pre-test, post-test and follow-up stages in two groups is presented in Figure 1.

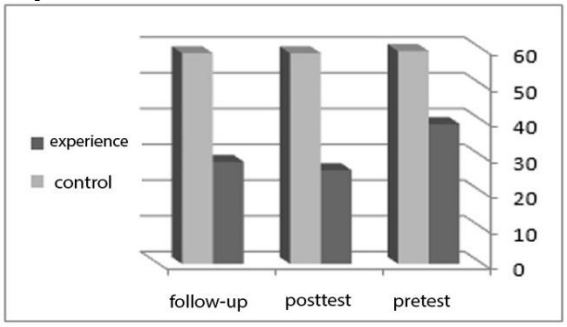

Figure 1. Column chart comparing the average scores of pain anxiety in the pre-test, post-test and follow-up stages in two groups

As seen in Figure 1, the average scores of pain anxiety in the post-test and follow-up phase in the experimental group are lower than the control group.

The results of analysis of variance with repeated measures regarding pain intensity are presented in Table 3.

Table 3. Results of analysis of variance with repeated measurements regarding pain intensity in pre-test, post-test and follow-up

Degree of freedom	Mean Square	F	Significance	Effect Size	Statistical Power	Sum of Squares
1.268	113.906	16.12	0.001	0.4	0.955	144.46
1	1800.688	10.961	0.003	0.314	0.988	1800.6
1.268	56.003	7.872	0.005	0.247	0.877	71.02

Based on the findings in Table 3, the difference between pain intensity scores in three phases of the research (time) is significant (*P*= 0.001). Also, the average scores of this variable in the two experimental and control groups also have a significant difference (*P*= 0.003). The results have shown that nearly 31.4% of the individual differences are related to the difference between the two groups. In addition, the interaction between research stages and group membership is also significant (*P*= 0.005). In other words, the difference between the pain intensity scores in the three stages of the research in the two groups is significant. The amount of these differences is around 0.247. That is, 24.7% of the variance or individual differences are related to the differences between the three stages of the test and group membership. Therefore, it can be concluded that hemoencephalography treatment has been effective in improving pain intensity in migraine patients.

The column chart comparing the mean pain intensity scores in the pre-test, post-test and follow-up stages in two groups is presented in Figure 2.

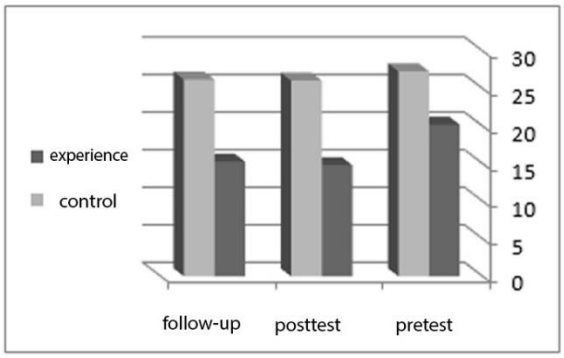

Figure 2. Column chart comparing the average scores of pain intensity in the pre-test, post-test and follow-up stages in two groups

As seen in Figure 2, the average scores of pain intensity in the post-test and follow-up phase in the experimental group are lower than the control group.

Discussion

Based on the findings, the difference between pain anxiety scores in three stages of the research is significant. Also, there is a significant difference in the average scores of this variable in the two experimental and control groups. Therefore, it can be concluded that hemoencephalography has reduced pain anxiety in patients suffering from migraine 25-55 years old in Isfahan city. The findings of the research are indirectly aligned with the findings of Kang (21) that the auxiliary biofeedback produced by training is effective in the treatment of migraine and its therapeutic effect is closely related to the improvement of anxiety level.

Also, the findings of the research are indirectly aligned with the findings of Jahanian, Najaf Abadi et al. (22) that neurofeedback training is effective in reducing anxiety, in other words, 70% of the changes in subjects' anxiety were due to neurofeedback.

Pain anxiety is a predictor of pain behaviors during treatment (9). If the anxiety caused by pain

is not treated, it will be revealed in the form of fear, sleep deprivation, depression and disability, and it will result in ineffective psychological coping and the patient's non-cooperation with treatments (13). The unique and important role of pain anxiety in the disability of patients with headache is more prominent. Based on this, on the one hand, pain leads to negative emotions, and on the other hand, negative emotions, in turn, cause the continuation of pain. In patients with migraine, firstly, during the pain, the patient seeks to escape from this feeling, as an example of fear of pain, and secondly, there is a possibility that the patient will be anxious in the future during the experience of pain, which is the result of avoidance behaviors. In both cases, whether the patient is seeking to stop pain or to avoid future pain, it is likely that he will change his behavior pattern in a meaningful way. Escape and avoidance behaviors and as a result change in activity can lead to a three-dimensional harmful syndrome of disability and depression. Since an anxious person has high blood pressure, heart rate is high, which causes the temperature of the active brain area to rise. In the hemoencephalography treatment, the feedback given to the brain reduces the temperature of the blood in the active area of the brain, as a result of which the activity of the sympathetic system decreases, and as a result, anxiety also decreases.

Based on the findings, the difference between the pain intensity scores in three phases of the research (time) is significant. Also, there is a significant difference in the average scores of this variable in the two experimental and control groups. Therefore, it can be concluded that hemoencephalography treatment has been effective in improving pain intensity in migraine patients. The finding of the research is directly aligned with the finding of John Gergi (23) that the relaxation method along with biofeedback causes a significant reduction in the duration, intensity and number of headache attacks. Also, based on the findings of Stock1 et al. (24) based on the effect of neurofeedback and thermal biofeedback on migraine patients, it was shown that biofeedback is effective in reducing the intensity of pain and is directly aligned.

The intensity of pain is a subjective experience and is affected by mood, environment, treatment conditions, cognitive factors, and other factors. The researchers came to the conclusion that the intensity of pain has an important effect on the quality of life and negative thoughts have a negative effect on the mental health of these people. It moderates the quality of life and negative thoughts cause the intensity of pain to have a greater impact on the quality and mental health. Hemoencephalography is a treatment that helps the patient reduce the intensity of pain through the voluntary control of the temperature of the active area of the brain. Considering that this treatment teaches a kind of conditioning to the brain, when the patient is in the pain stage, the brain is conditioned with the help of this method and acts automatically and reduces the temperature of the active area, which causes a reduction It is suggested that this treatment be tested on other groups in order to estimate its validity with higher certainty. It is also suggested that this treatment method be performed with other psychological treatment methods on this statistical population. In order to reduce pain anxiety, treatment sessions should be used for patients with migraine and training workshops should be organized for therapists and counselors. Reducing the intensity of sensory side pain of this treatment method should be organized in counseling and psychotherapy centers (in clinical settings) for migraine patients and training workshops for counselors and therapists.

Hemoencephalography is a method for blood flow dynamics as a useful treatment to reduce pain, which is one of the most common symptoms of migraine. With the help of this method, brain activity can be regulated. Hemoencephalography is a form of operant conditioning. In this method, reinforcement takes place only when the client's brain shows the correct response (temperature reduction in the active area). This reinforcement may happen in the form of a sound or a computer image, which can reduce the pain intensity and pain anxiety in the patient. Anxiety caused by pain can be manifested in the form of fear, sleep deprivation, depression and disability, and it will result in ineffective psychological coping and the patient's non-cooperation with treatments, and there is a possibility that the patient will experience pain in the future. Pain becomes anxious and the result is avoidance behaviors. Since the anxious person

has high blood pressure, high heart rate, and this causes the temperature of the active brain area to rise and escape and avoidance behavior is observed, which is the result of a change in the activity of the sympathetic system. Hemoencephalography treatment with the feedback it gives to the brain causes a decrease in the blood temperature of the active area of the brain, and as a result, the activity of the sympathetic system decreases, and as a result, anxiety also decreases.

Conclusion

The research findings showed that hemoencephalography treatment as a treatment method is effective in reducing pain intensity and pain anxiety in migraine patients.

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