

HEART RATE CHANGES ASSOCIATED WITH BIOFEEDBACK TRAINING

Hitanshu Agnihotri, Maman Paul, Jaspal Singh Sandhu

Department of sports medicine and physiotherapy,

Guru Nanak Dev University, Amritsar

Abstract

The present study compared the heart rate changes associated with two most commonly used biofeedback relaxation techniques in the treatment of Generalized Anxiety Disorder (GAD). 45 individuals with GAD (as defined by DSM-IV TR) were randomly assigned to three groups: Group I (n = 15) received EMG biofeedback relaxation training; Group II (n = 15) received alpha-EEG biofeedback relaxation training and Group III (n=15) control group. Both EMG and EEG groups resulted in more consistent pattern of generalized relaxation changes reflected in heart rate as compared to control group. At follow-up, maintenance of effects was not observed in both treatment groups.

Key words: Generalized anxiety disorder(GAD), frontalis-EMG biofeedback, alpha -EEG biofeedback, relaxation, heart rate.

Introduction

Anxiety in one form or other is a universally experienced human emotion. When the intensity and

duration of anxiety is excessive and above a defined threshold, the anxiety is considered pathological and forms the basis of anxiety disorders. Generalized Anxiety Disorder (GAD) is a severe and chronic anxiety disorder with a lifetime prevalence of 5-6% in general population (1). GAD appears to be commonly associated with chronic medical illness (Hypertension, diabetes and heart diseases) (2, 3). Students are prone to anxiety and often display characteristic symptoms of anxiety such as increased heart rate, dizziness, nervousness etc. (4).

Research documents that biofeedback alone or in combination with other behavioral therapies is effective for treating a variety of medical and psychological disorders. Biofeedback training is a mind body therapy using electronic instruments to help individual gain awareness and control over various psychophysiological processes (5, 6, 7).

Biofeedback mediated electromyographic relaxation is an extension of progressive relaxation and autogenic training (8). The frontalis muscle being one of the most difficult muscles in the body to relax

voluntarily, is expected to generalize the relaxation to the whole body (9). EEG biofeedback or Neurofeedback training is an encouraging development that holds promise as a method for modifying biological brain patterns associated with a variety of mental health and medical disorders particularly because it is non invasive and seldom associated with even mild side effects (10). Significant decrease in heart rate reactivity to stressor was observed with alpha increase EEG biofeedback training (11). A reliable change in heart rate accompanied EMG decrease training (12).

The present study was undertaken to compare the heart rate changes associated with EMG decrease and alpha-EEG increase biofeedback trainings.

Materials And Methods

Procedure

The study was approved by Institutional Medical Ethics Committee of Guru Nanak Dev University, Amritsar prior to the start of data collection. Announcements in the community were made about the availability of relaxation therapy for generalized anxiety problems of 18-30 years age-group. Individuals who contacted for the therapy were interviewed to screen out the patients of GAD on the basis of DSM-IV TR criteria (13). The patients were diagnosed by the therapist using a semi-structured interview. Patients of both the treatment groups were explained about the training and

previous research supporting the effectiveness of biofeedback training in causing relaxation. Only subjects willing to participate in the study were recruited. A written informed consent was taken from each subject prior to the beginning of the training. Out of 45 individuals (24 females 21 males), 15 each were randomly assigned to (a) Group-I: EMG biofeedback group; (b) Group-II: EEG group and (c) Group-III: control group.

Assessment

Heart rate monitor (Polar Heart Rate Monitor S410 Model with the T61 Transmitter and polar 410 wrist receiver) was used to measure resting heart rate pre and post treatment.

Treatment Protocol

Patients in two experimental groups were treated individually for 12 successive days at Sports Psychology Laboratory, Department of Sports Medicine and Physiotherapy, Guru Nanak Dev University, Amritsar. The treatment room was neat and clean with no disturbing sounds and glaring lights. All treatment sessions except the first and last lasted approximately for 35 minutes. After the application of electrodes, the patient was asked to sit comfortably for a 5 minute baseline period. There then followed a 25 minute phase of either of two biofeedback trainings. All the patients were asked to practice relaxation at home once a day for 25 minutes. It was strictly determined by the therapist whether each patient

regularly practiced at home throughout the treatment period.

Frontalis EMG biofeedback group

A Medicaid system EMG Biofeedback Biotrainer MBF-4000 device was used. The feedback was a visual display with 17 bars (11 green on left, 1 yellow in middle, and 5 red at right). The display showed green bars with decrease and red with increase in tension of frontalis muscle respectively. The balance control was brought to yellow bar at the beginning of the session. The patient was instructed to glow the green bars and not let the red bars to glow. Subject was instructed to find a way to glow green bars in order to relax himself. The feedback control was kept at maximum at the beginning of each treatment session to assist the patient in glowing the green bars with a minimal effort and gradually decreased when patient was able to glow all the green bars. Intermittent positive verbal reinforcement such as "you are getting relaxed. Try to decrease the tension in your body." was provided every few minutes by the therapist.

Alpha – EEG biofeedback group

Visual alpha enhancement biofeedback training was given to the subject. A Medicaid Alpha-EEG Biofeedback Biotrainer EBF-5000 device was used. The feedback display was similar to EMG feedback. The display showed green bars with increase and red with decrease in amounts of alpha activity respectively.

Similar positive intermittent instructions as in EMG group were given every few minutes by the therapist.

Control group

The patients in the control group were given no treatment. Heart rate was measured on day 1 and day 12. However, the participants were taught Jacobson's Progressive Muscle Relaxation after the completion of study on ethical grounds.

Follow-up

Two weeks after the completion of training all the patients of both treatment groups were again called for measurement of heart rate.

Statistical Analysis

Intra and inter group comparisons were analyzed using paired t-test and unpaired t-test respectively. One-way ANOVA and Post Hoc Multiple Scheffe Tests were done pre and post treatment to find changes between and within groups.

Results

Inter group comparison of all three groups showed non significant differences at pre-treatment (Table 1). Intra group comparison (Figure 1) showed statistically significant reduction in heart rate in EMG ($t=19.37$, $p<0.001$) and EEG ($t=9.37$, $p<0.001$) groups while, control group did not show statistically significant changes ($t=0.07$, $p>0.05$).

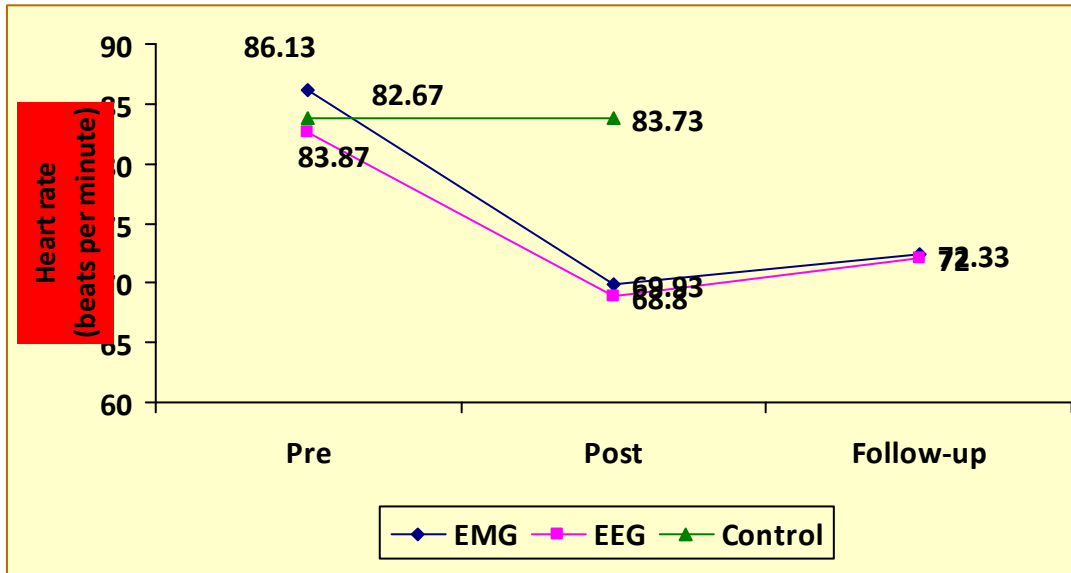


Figure 1: Intra group comparisons of all three groups for heart rate.

Statistically significant results were observed in both EMG and EEG groups as compared to control group at post-treatment (Table 1). One-way ANOVA with Post Hoc Multiple Scheffe Range Test at post-treatment ($F=18.13$, $p<0.001$) showed most significant reduction in heart rate in EEG group followed by EMG group.

Table 1: Inter group comparison of all three groups for heart rate at pre and post treatment

	EMG Group Gp-I		EEG Group Gp-II		Control Group Gp-III		t-value		
	Mean	S.D.	Mean	S.D.	Mean	S.D.	t ₁₋₂	t ₂₋₃	t ₁₋₃
Pre-treatment	86.13	7.49	82.67	10.49	83.87	8.62	1.04 ^{ns}	0.34 ^{ns}	0.77 ^{ns}
Post-treatment	69.93	8.17	68.80	7.88	83.73	6.54	0.39 ^{ns}	5.65 ^{**}	5.11 ^{**}

* indicates $p\leq 0.05$ ** indicates $p\leq 0.001$ ns = Non-significant

Follow-Up

At two weeks follow-up, non-significant differences were observed between EMG and EEG groups (Table 2). Significant changes were observed in both EMG and EEG groups as compared to post treatment values.

Table 2: Inter group comparison for heart rate of both the treatment groups at follow-up

Parameters	EMG Group		EEG Group		t-value
Heart Rate	72.33	8.88	72.00	5.49	0.12 ^{ns}

* indicates $p \leq 0.05$ ** indicates $p \leq 0.001$ ns = Non-significant

Discussion

An increased heart rate is associated with a stressed and anxious state of mind. The present study evaluated the efficacy of two short-term biofeedback relaxation techniques in reducing heart rate among GAD patients. Various methods of biofeedback assisted relaxation have been perceived well in the management of several cardiovascular diseases. A significant decrease of 18.80% was observed in EMG biofeedback group while, EEG group demonstrated a decrease of 16.78%. On the other hand, control group showed a change of only 0.17%. An increase in sympathetic activity increases heart rate, stroke volume and peripheral blood flow. One can monitor and through relaxation, control the effects of stress, tension or anxiety (14).

Decreased muscle tension through EMG biofeedback training leads to generalization of relaxation by decreasing the signs of sympathetic and increasing the parasympathetic tone as well as by deactivation of hormonal signs of hypothalamic-pituitary adrenal axis. A similar belief was proposed by Khanna et al. (2007) for progressive muscle relaxation training (4). Sahni (2005) suggested that achievement of deep muscle

relaxation with electromyographic feedback can contribute to overall level of relaxation and have significant clinical impact on stress related disorders (15).

EEG biofeedback training leads to Operant conditioning and has been found to be effective in modifying brain functions associated with mental health and medical disorders (10).

The reason for loss of improvement at follow-up may be that the patients did not practice at home post treatment. However, mean values indicated a significant level of relaxation as compared to pre-treatment values. Therefore, willingness on the part of the patient to participate in the treatment process, including compliance with home practice has a specific impact on the treatment efficacy of these techniques.

Conclusion

From the present study, it can be concluded that biofeedback treatment demonstrably leads to reduction in heart rate. Both biofeedback relaxation techniques are equally effective in imparting relaxation with EEG biofeedback training at slightly upper edge as compared to EMG group. The findings of present study have

provided a stimulus for incorporation of these relaxation trainings as an effective method to reduce hypertension and other anxiety disorders.. The future research should focus on a longer treatment duration

as well as follow-up. The comparative efficacy of alpha decrease and EMG decrease biofeedback relaxation trainings in the treatment of GAD also needs to be investigated.

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