Athens Institute for Education and Research
ATINER

ATINER's Conference Paper Series
PSY2018-2461

Neurofeedback Training: An Innovative Technique to Self-Regulate Stress and Anxiety

Chua Bee Seok
Senior Lecturer
Universiti Malaysia Sabah
Malaysia

Jasmine Adela Mutang
Lecturer
Universiti Malaysia Sabah
Malaysia

An Introduction to ATINER's Conference Paper Series

Conference papers are research/policy papers written and presented by academics at one of ATINER's academic events. ATINER's association started to publish this conference paper series in 2012. All published conference papers go through an initial peer review aiming at disseminating and improving the ideas expressed in each work. Authors welcome comments

Dr. Gregory T. Papanikos
President
Athens Institute for Education and Research

This paper should be cited as follows:

Seok, C.B., and Mutang, J. A. (2018). **"Neurofeedback Training: An Innovative Technique To Self-Regulate Stress And Anxiety",** Athens: ATINER'S Conference Paper Series, No: **PSY2018-2461.**

Athens Institute for Education and Research
8 Valaoritou Street, Kolonaki, 10671 Athens, Greece
Tel: + 30 210 3634210 Fax: + 30 210 3634209 Email: info@atiner.gr URL: www.atiner.gr
URL Conference Papers Series: www.atiner.gr/papers.htm

ISSN: 2241-2891
21/06/2018

Neurofeedback Training: An Innovative Technique to Self-Regulate Stress And Anxiety

Chua Bee Seok
Senior Lecturer
Universiti Malaysia Sabah
Malaysia

Jasmine Adela Mutang
Lecturer
Universiti Malaysia Sabah
Malaysia

Abstract

This study aims to use an innovative neurofeedback training, to help participants learn how to regulate the unmanaged emotions that cause by stress and anxiety and to reduce their stress and anxiety level. This case study involved two volunteer employees from one company in Kota Kinabalu, Sabah. The participants to be included in this study had been exposed to work-related stress and scored high in Depression, Anxiety, and Stress Scale–21 (DASS-21) and State-Trait Anxiety Inventory (STAI) in pre-test. Based on the literatures and recommendation from expert (Perl, 2017), a neurofeedback protocol for each participant were decided. During neurofeedback training, the participants were comfortably seated with their head and arm sat rest. Electroencephalic activity was recorded with one sensor/electrode attached on the participant's head on the position C3 or C4 (according to International10–20 system), one electrode attached on one ear lobe as reference (A1 or A2) and another earlobe was connected to circuit ground. The participants were trained for either Beta or SMR training. As suggested we start with C3 Beta training follow by C4 SMR training for the two participants. Then, they complete an arousal assessment checklist after each session, and the participants continue to be trained for actual study based on their responses (either C3 Beta training or C4 SMR training) on the arousal assessment checklist after each session. After 20 sessions of neurofeedback training post-test was conducted the effectiveness of the neurofeedback training in reducing participants' stress and anxiety level was tested by observing the changes in the severity levels of the Depression, Anxiety, and Stress Scale–21 (DASS-21) and State-Trait Anxiety Inventory (STAI) as well as the mean scores of the rewarded and inhibited bands of the neurofeedback training protocol.

Keywords: Neurofeedback, stress, anxiety

Acknowledgment: This research work is supported by the Research Priority Area Scheme (Project: SBK283-SS-2016) under Universiti Malaysia Sabah.

Introduction

Work-related stress exists in all human and across different professions. Stress in the workplace seem to have adverse impact on employees work behavior such as reduced employees' organizational citizenship behavior, organizational commitment and job satisfaction or it may increase employee turnover intention or withdrawal behavior (Fairbrother & Warn, 2003). The literatures indicated that stress can lowers employees' productivity (Pitariu, Radu and Chraif, 2009), impair employees performance in the workplace (Fairbrother & Warn, 2003), increase employees absenteeism, poor relationships with other employees, indecisiveness and irritability (Stranks, 2005). Stein and Cutler (2001) claims that accidents at workplace are either directly or indirectly results of work-related stress which costs employers approximately 120 billion dollars annually.

Stress is also a significant predictor to a complex changes on the psychological, emotional, cognitive and physical level. Stranks (2005) claims that employees who perceive higher stress are exhibit tiredness, anxiety and lack of motivation. High anxiety level and tiredness (psychological), increased potential for error and work-related accidents (cognitive), it also increase illness such as headaches, general aches and pains, and dizziness (physical). Besides that numerous of studies have also reported that work-related stress negatively affect individual employee health and well-being. Production of high level of cortisol hormone as a result of stress weaken immune system and increase susceptibility for disease. Chandola *et al.* (2006) studied the relationships between work stress, behavioral risk factors, incidence of coronary heart disease, cortisol levels, and metabolic syndrome (e.g., stress-related obesity) in 10,308 London civil servants aged 35–55. They found out that work stress was significantly correlated with coronary heart disease and high rises in cortisol. While Cohen *et al.* (2007) reported that there was a positive significant link between stress and risk for heart attacks, depression, cancer and the progression of HIV and AIDS.

In general, stress seems to play its role in mind body interaction that triggers a sympathetic nervous system response in the individual. Or in another word it is an individual negative feelings, perceptions, and emotions that are triggered when they perceived challenge or threat (McCraty & Tomasino, 2006). These negative feelings and emotional processes in turn will drive that individual to response and adapt to the stressful situation (Barrios-Choplin *et al.* 1997). Thus, internal emotional unrest, such as feelings of frustration, anger, worry, anxiety, fear, insecurity, depression, or resentment are the actual sources of the "stress'' that people experience. Based on McCraty and Tomasino (2006) and Barrios-Choplin *et al.* (1997) suggestions, the intervention program used in this study adopts an emotion-focused perspective on stress reduction and train the participants in self-regulation skills designed to target stress at its emotional source.

The ability to cope or tolerate to high amounts of stress are varies according to the individual personality trait, coping strategies used, level of tolerance, hardy threshold to stress and ability to self-regulate stress. Individuals with a high tolerance for stress, healthier coping strategy, higher hardy threshold to stress and able to self-regulate stress are more productive, motivated, healthy and happy. On

the other hand, individuals who unable to self-regulate stress effectively are vulnerable to even mild degrees of stress.

When it comes to self-regulating stress effectively, everyone have their own personal strategies. Some individuals are able to self-regulate their stress through activities such as listening to relaxing and classical music (Labbe, Schmidt, Babin, & Pharr, 2007), exercise and meditation (Krisanaprakornkit, Krisanaprakornkit, Piyavhatkul, &Laopaiboon, 2006), attending relaxation therapy (Lehrer, Woolfolk & Sime, 2007) or stress management program to reduce stress. Those are commonly used cognitive – behavioral interventions or coping strategies (Richardson & Rothstein, 2008). However, in some situations these strategies do not seem to work and stress remains at high levels even after applying these techniques and when stress caused more severe psychological or health problems, prescribed medication could be the solution. Neurofeedback training is another intervention which has recently shown its potential in the management of stress and anxiety (Sherlin, Gevirtz, Wyckoff, & Muench, 2009; Nolan *et al.*, 2005). Neurofeedback training also has been supported by many researches. It beneficial in management of numerous mental disorders, including anxiety, depression, asleep disorders, attention deficit disorder, headaches and migraines, and other emotional issues. It also showed its effectiveness in treating people who have organic brain disorders, such as autism, cerebral palsy and seizures. (Grohol, 2015).

While there is some evidence to support the efficacy of neurofeedback for numerous mental disorders, psychological and physical problem, the efficacy of neurofeedback for effectively self-regulating stress still isn't a lot. In addition, most of these researches are considered small-scale to the point that its efficacy still cannot be fully established. Thus, his study aims to use an innovative neurofeedback training, to help participants learn how to regulate the unmanaged emotions that are cause by stress. This study also aims to test the efficacy of neurofeedback training in helping the participants to self-regulate stress.

Literature Review

What is Neurofeedback Training?

Neurofeedback is significantly different than the common strategies of self-regulation or commonly use cognitive – behavioral interventions. It is also called EEG biofeedback or brainwave biofeedback. Neurofeedback primary focus is on changing the electrical activity of the brain, which is the foundation of the body's emotional and behavioral functions. Its combines the capability of the electroencephalogram (EEG) with advances in computer technology and operant conditioning (Swingle, 2010). Neurofeedback allowing the brain to recognize itself, and change or self-regulate its electrical activity as guided by specific treatment protocols that either reward (strengthen) or inhibit (weaken) targeted brainwave patterns. Neurofeedback can teach clients how to interrupt dysfunctional neurological patterns and establish more stable brainwave patterns.

Neurofeedback is based upon two major tenets. The first is that the EEG reliably reflects measureable mental states. The second is that these states can be trained (Thompson & Thompson, 2003). There are two major goals in neurofeedback training. The first is to increase or decrease a particular brainwave frequency in a selected area of the brain that has been found to be related to a client's presenting emotional or behavioral problem. The second goal is to improve the overall stability and communication of neuronal networks across the brain and between or within its hemisferes. Neurofeedback restores brain function, rhythm, timing, frequency, and synchronization that allow the brain to better orchestrate perception, motor action, and conscious experience (Farmer, 2002).

During neurofeedback, a client sits in a comfortable chair and watches a monitor that plays a video game, music or movie. On the client's head and ears are attached three to five sensors. One or two sensors are located at targeted brain locations. Two or three other sensors are attached to the ears or chest and act as a referent and/or ground for the active sensors. The sensors are hardwired and attached to an EEG amplifier. The EEG amplifier then sends the EEG information to a computer where a specialized software program allows the neurotherapist to select, monitor, and interact with a specific training protocol.

As a client focuses on the desired brainwave, the video game, music, or movie will play. When the client wanders away from the targeted brainwave, the game, music, or video will stop. The brain wants to be stimulated, so it is naturally motivated to relocate the targeted brainwave. In addition, unique tones such as a bird chirping, a bleep alert, or a horn sound can inform a client when he or she is becoming too anxious or too drowsy. This signals the client to refocus and better remain at the targeted brainwave. Training sessions usually last between 30 and 45 minutes. It can take from 10 to 60 sessions to achieve a desired result. The usual number of session is 20 to 40 sessions (Chaplin & Russell-Chapin, 2014).

Work-related stress has a very detrimental effect on the worker. It can produce depression, anxiety, absenteeism, vulnerability to work injuries and job burn-out. There are many approaches to stress management that the employer and worker can use in creating an environment to reduce stress. Neurofeedback is another innovative intervention which has recently shown promising results in the management of stress and anxiety (Sherlin, Gevirtz, Wyckoff, &Muench, 2009; Nolan et al., 2005) as well as being beneficial in the management of numerous diseases, both mental and physical (Hassett *et al*., 2007; Lehrer *et al*., 2007). With Neurofeedback training, the central nervous system can be stabilised. Additionally, the agitation caused by stress can be calmed down and self-control can be increased. This will decrease feelings of anxiety or anger and improve, self-esteem, concentration and organisational skills among employees.

Objective(s) of the Research

1. This study aims to use an innovative neurofeedback training, to help participants learn how to regulate the unmanaged emotions that cause by stress and anxiety.

2. This study also aims to reduce level of stress and anxiety of the participants.

Methodology

Participants

This case study involved two volunteer employees (identified as Participant F and Participant R) from one company in Kota Kinabalu, Sabah. The two participants who involved in this study had been exposed to work-related stress and scored high in Depression, Anxiety, and Stress Scale–21 (DASS-21) and State-Trait Anxiety Inventory (STAI) in pre-test. In DASS-21, Participant F scored 26 which indicated severe level in stress, scored 24 (severe) in depression and scored 34 (extremely severe) in anxiety. This participant also reported severe level of state anxiety (61 score) and extremely severe (69 score) level of trait anxiety in STAI. In DASS-21 Participant R reported moderate level of stress (scored 18) and depression (scored 16), but reported extremely severe level of anxiety (scored 20). The participant also showed moderate level of state anxiety (55 score) and severe (59 score) level of trait anxiety in STAI.Additionally, the two participants stated that they easily annoyed, angered, or upset and quick to react anxiety symptoms and having slight difficulty to fall asleep. The two participants were asked to sign informed consent prior to participation in the study and the neurofeedback protocol applied in this study was based on the suggestion by the expert in the field.

Instruments

Depression, Anxiety, and Stress Scale–21 (DASS-21) designed by Lovibond and Lovibond (1995) used to measure level of stress, anxiety and depression of the participants. The scale is a self-report measure that consist of seven items in each subscale to measure the constructs of depression, anxiety, and stress. Participants were asked to respond to each item by rating the frequency and severity of experiencing symptoms of stress over the previous week. DASS-21 using a 4-point Likert scale with 0 = *did not apply to me at all and* 3 = *applied to me very much or most of the time*.

State-Trait Anxiety Inventory (STAI) developed by Spielberger, Gorsuch, Lushene, Vagg, and Jacobs (1983) has been widely used in a number of chronic medical conditions including rheumatic conditions such as rheumatoid arthritis, systemic lupus erythematosus, fibromyalgia, and other musculoskeletal condition (APA, 2017). The inventory consists of 40 items. The first 20 items were used to measure state anxiety by asking how participants feel “right now” and the others 20 items to measure trait anxiety. The items were rated on a 4-point Likert scale (Julian, 2011), where state anxiety items assess intensity of current feeling (from 1 = not at all to 4 = very much so) and trait anxiety items measure frequency of feeling in general (from 1 = almost never to 4 = almost always). DASS-21 and STAI were

administered before neurofeedback training (as pre-test) and at the end of neurofeedback training (post-test).

Neurofeedback Training

The two volunteer participants were introduced to neurofeedback training to help them to learn how to regulate the unmanaged emotions that cause by stress and anxiety and on the same time to reduce their stress and anxiety level. As suggested by Chaplin and Russell-Chapin (2014) the usual number of neurofeedback session is 20 to 40 sessions. In this study, up to 20 session of neurofeedback per participant will be carried out with EEGerNeurofeedback System. Neurofeedback training will held twice a week per participant with 30 minute for each session. EEG registration was conducted by 1 connected electrode to head and 2 connected electrodes to earlobes.

As suggested by the field expert, the neurofeedback training was starting with Beta training by rewarding 15–18 Hz brainwaves (beta), while simultaneously inhibit 2-5 Hz brainwaves (delta), 6-9Hz brainwaves (theta) and 22–36 Hz brainwaves (high beta) in the left center of the brain (C3-A1) for one session follow by SMR training with rewarding 12-15 Hz brainwaves (SMR), inhibit 2-5 Hz brainwaves (delta), 6-9Hz brainwaves (theta) and 22–36 Hz brainwaves (high beta) in the right center of the brain (C4-A2) for another one session. After each trial session, the two participants were asked to complete an arousal assessment checklist. The participants were then continue to be trained for actual neurofeedback training based on their responses (C3 Beta training or C4 SMR training) on the arousal assessment checklist. In this study, the participants were trained SMR. After 20 sessions of neurofeedback training post-test was conducted to measure the effectiveness of neurofeedback training in reducing level of stress and anxiety of the participants.

During neurofeedback training, the participants were seated in a comfortable armchair and electrodes were applied and watches a monitor that plays a video game. The participants were asked to increase SMR amplitude through the video game, while simultaneously decrease delta, theta and high beta amplitude in the region C4 during neurofeedback training. In this study, feedback thresholds for SMR training were set to automatic. This protocol allows the thresholds adjust automatically for all four (delta, theta, SMR and Hi-beta) amplitudes in order to maximize rewards to encourage training and at the same time allows the system to slowly increase the level of difficulty of the video game.

Results

Level of Anxiety, Depression and Stress of Participants in Pre and Post Test

In pre-test, the two participants were administered the Depression, Anxiety, and Stress Scale–21 (DASS-21) and State-Trait Anxiety Inventory (STAI).DASS and STAI Severity Ratings are shown in Table 1 and 2.

Table 1.*Severity Ratings of Depression, Anxiety, and Stress Scale–21 (DASS-21)*

Severity	Depression	Anxiety	Stress
Normal	0-9	0-7	0-14
Mild	10-13	8-9	15-18
Moderate	14-20	10-14	19-25
Severe	21-27	15-19	26-33
Extremely Severe	28+	20+	34+

Table 2.*Severity Ratings of State-Trait Anxiety Inventory (STAI)*

Severity	State Anxiety	Trait Anxiety
Normal	20-32	20-32
Mild	33-44	33-44
Moderate	45-56	45-56
Severe	57-68	57-68
Extremely Severe	69+	69+

Severity analysis on DASS-21 showed that Participant F scored 26 (severe) in stress, 24 (severe) in depression and scored 34 (extremely severe) in anxiety. Meanwhile, severity analysis on STAI for Participant F reported that the participant also reported severe level of state anxiety (61 score) and extremely severe (69 score) level of trait anxiety. Severity ratings for Participant R in DASS-21 indicated the participant experience moderate level of stress (scored 18) and depression (scored 16), but reported extremely severe level of anxiety (scored 20). The result also showed moderate level of state anxiety (55 score) and severe (59 score) level of trait anxiety for Participant R.

Table 3. *Severity Ratings of Depression, Anxiety, and Stress Scale–21 (DASS-21) State-Trait Anxiety Inventory (STAI) in pre and post-test.*

Variables	Pre-Test				Post-Test			
	Participant F		Participant R		Participant F		Participant R	
	Score	Level	Score	Level	Score	Level	Score	Level
Depression	24	Severe	16	Moderate	18	Moderate	18	Moderate
Anxiety	34	Extremely Severe	20	Extremely Severe	20	Extremely Severe	12	Moderate
Stress	26	Severe	18	Moderate	16	Mild	14	Normal
State Anxiety	61	Severe	55	Moderate	55	Moderate	40	Mild
Trait Anxiety	69	Extremely Severe	59	Severe	46	Moderate	37	Mild

In post-test, after 20 session of the neurofeedback training severity analysis on DASS-21 and STAI suggested that the two participants' scores on all scales of the DASS-21 and STAI were reduced. For Participant F, her stress level from severe had been reduced to mild (16 score), depression level from severe had been reduced to moderate (18 score). However, her anxiety level still remains at the level of extremely severe but her anxiety score had been reduced from 34 score to 20 score. Her state anxiety level (from severe) and trait anxiety level (from extremely severe) reduced to moderate level.

Severity ratings on DASS-21 and STAI for Participant R in post-test also decrease after the 20 session of neurofeedback training. Her post-test stress score decrease four points to normal level. Her depression level remain at moderate level but her post-test depression score had been decrease. Post-test anxiety scores suggested a significant reduction of Participant R's stress level from extremely severe (20 score) to moderate level (12 score).Her post-test state anxiety level (from moderate) and trait anxiety level (from severe) reduced to mild.

Means Score of Delta, Theta, SMR and Hi-Beta of Participants in Neurofeedback Training

The first five session of neurofeedback training suggested average means of 14.72 for delta brainwaves,16.72 for theta brainwaves, 11.89 for SMR brainwaves and 9.42 for Hi-Beta brainwaves for Participant F (refer to Table 4). For Participant R, the earns score of Delta, Theta, SMR and Hi-Beta in the first five session of neurofeedback training indicated average means of 17.08 for delta brainwaves, 11.72 for theta brainwaves, 6.71 for SMR brainwaves and 9.30 for Hi-Beta brainwaves at the right center of brain (C4-A2)(refer to Table 5).

Table 4. *Means Score of Delta, Theta, SMR and Hi-Beta of Participants in Pre and Post Test Neurofeedback Training: Participant F*

Session	Delta Inhibit 2-5	Theta Inhibit 6-9	SMR Reward 12-15	Hi-Beta Inhibit 22-36
1	14.66	20.56	17.18	9.32
2	15.44	19.92	16.08	9.26
3	14.00	14.18	9.02	10
4	14.98	15.4	9.8	10.84
5	14.52	13.54	7.36	7.7
Mean	**14.72**	**16.72**	**11.89**	**9.42**
6	15.70	13.02	7.86	9.88
7	16.80	14.96	12.72	7.76
8	16.98	11.60	10.80	6.76
9	15.22	13.70	10.34	8.30
10	15.74	19.96	8.30	6.68
11	15.68	13.98	7.50	7.76
12	15.62	13.84	7.75	7.62
13	15.55	13.76	7.82	7.54
14	15.52	13.68	7.84	7.48
15	15.48	13.54	7.95	7.42
16	15.36	13.45	8.08	7.36
17	15.24	13.38	8.18	7.26
18	15.06	13.12	8.36	7.18
19	14.88	13.05	8.55	7.04
20	14.80	13.02	8.74	6.96
Min	**15.07**	**13.20**	**8.38**	**7.16**

Table 5. *Means Score of Delta, Theta, SMR and Hi-Beta of Participants in Pre and Post Test Neurofeedback Training: Participant R*

Session	Delta Inhibit 2-5	Theta Inhibit 6-9	SMR Reward 12-15	Hi-Beta Inhibit 22-36
1	16.24	10	5.96	9.14
2	15.68	16.4	8.24	8.62
3	19.12	11.3	6.3	10.58
4	17.48	10.04	6.42	8.64
5	16.86	10.76	6.62	9.52
Mean	**17.08**	**11.70**	**6.71**	**9.30**
6	17.42	11.10	7.58	10.26
7	15.22	10.68	7.36	9.26
8	14.48	10.88	8.16	9.56
9	14.36	11.68	9.28	11.36
10	16.2	14.38	9.56	9.18
11	15.68	13.76	7.58	10.38
12	15.62	13.54	7.62	10.26
13	15.56	13.48	7.67	10.22
14	15.48	13.36	7.75	10.04
15	15.44	13.32	7.86	9.94
16	15.32	13.25	7.98	9.84
17	15.28	13.17	8.08	9.78
18	14.98	13.02	8.14	9.56
19	14.82	12.96	8.24	9.45
20	14.74	12.84	8.36	9.38
Mean	**15.03**	**13.05**	**8.16**	**9.60**

The last five neurofeedback training for Participant F suggested average means of 15.07 for delta brain waves, 13.20 for theta brainwaves, 8.38 for SMR brainwaves, and 7.16 for Hi-betabrainwaves. The last five neurofeedback training for Participant R reported average means of 15.03 for delta brainwaves, 13.05 for theta brainwaves, 8.16 for SMR brainwaves, and 9.60 for Hi-beta brain wave sat the right center of brain (C4-A2). Participant F stated that she experienced with a positive mood, feeling physically fresh, good appetite and able to sleep well at the last five session of neurofeedback training. Participant R also stated that she was feeling fresh and energetic in the morning, able to sleep soundly, good appetite, positive mood and focus.

Discussion

Stress is common in workplace however if not managed well may cause influence productivity, performance, loss to the company and many other negative impacts both on employees and employers (Fairbrother & Warn, 2003; Pitariu, Radu & Chraif, 2009; Stranks, 2005; Stein, 2001). This study provides evidence regarding

the use of neurofeedback to regulate stress and anxiety. The 20 sessions of neurofeedback training produced improvement in the symptomology of stress and anxiety for both participants. Thus, neurofeedback training by rewarding SMR (12-15Hz) at C4-A1 for both participants provides promising alternative treatment for individuals with work related stress and anxiety.

The findings of this study showed a decreased in stress and anxiety related symptoms from post training based on the severity ratings of DASS-21 and STAI. Furthermore, the mean scores of the rewarded wave (SMR 12-15Hz) and inhibited waves (delta 2-5 Hz, theta 6-9 Hz, and hi-beta 22-36 Hz) for both participants also showed promising results. The severity levels all three subscales (depression, anxiety, and stress) ofDASS-21 and the sub scales of the STAI (state anxiety and trait anxiety) in pre and post-test revealed significant decrease except for participant F in her anxiety level. In terms of verbal report by both participant, they reported better somatic symptoms after the 20 sessions which indicated that neurofeedback training is a promising alternative for managing stress and anxiety as proposed by other researchers (Sherlin, Gevirtz, Wyckoff, & Muench, 2009; Nolan et al., 2005).

Conclusion

Since this study is a case study which involved only two participants, future studies should involve a bigger sample size, a control group with random assignment and usage of both subjective and objective measuring tools. The number of sessions conducted in this study was 20 sessions as suggested by Chaplin and Russell-Chapin (2014) which is 20 to 40 sessions. Future studies may focus on determining the optimal number of training sessions for individual with work related stress and anxiety symptoms.

In conclusion, the findings of this study suggest that the neurofeedback training could be apply as an alternative treatment for stress and anxiety. Although the training maybe time consuming, having medication, which have side effects can be more detrimental to one's health. Therefore, with more research to further confirm the effectiveness of the neurofeedback training in the future may shed some light and hope for individuals who are looking for safer and less invasive treatment for stress and anxiety.

Reference

Barrios-Choplin, B., McCraty, R., & Cryer, B. (1997). An inner quality approach to reducing stress and improving physical and emotional wellbeing at work. *Stress Medicine, 13*(3), 193-201.

Chandola, T., Brunner, E., & Marmot, M. (2006). Chronic stress at work and the metabolic syndrome: Prospective study. *British Medical Journal, 332,* 521-525.

Chaplin, T. J., & Russell-Chapin, L. A. (2014). *Neurotherapy and neurofeedback: Brain-based treatment for psychological and behavioral problems.* US: Routledge.

Cohen, S., Janicki-Deverts, D., & Miller, G.G. (2007). Psychological stress and disease. *Journal of the American Medical Association, 298*(14), 1685-1687. Coi:10.1001/jama. 298.14.1685.

Fairbrother, K., & Warn, J. (2003). Workplace dimensions, stress and job satisfaction. *Journal ofManagerial Psychology, 18*, 8-21.

Farmer, S. (2002).Neural rhythms in Parkinson's disease. *Brain Journal of Neurology, 125*(6), 1176-1176.

Grohol, J. M. (2015). Neurofeedback Training for Your Brain.retrieved from http://psych central.com/lib/neurofeedback-training-for-your-brain.

Krisanaprakornkit, T., Krisanaprakornkit, W., Piyavhatkul, N., &Laopaiboon, M. (2006). Meditation therapy for anxiety disorders. *Cochrane Database of Systematic Review, 1*.

Labbe, E., Schmidt, N., Babin, J., & Pharr, M. (2007). Coping with stress: The effectiveness of different types of music. *Applied Psychophysiology and Biofeedback, 32*, 163-168.

Lehrer, P. M., Woolfolk, R. L., & Sime, W. E. (2007). *Principles and practice of stress management (3rd ed.)* New York: Guilford Press.

Lovibond, S.H. & Lovibond, P.F. (1995). Manual for the Depression Anxiety Stress Scales. (2nd. Ed.) Sydney: Psychology Foundation. ISBN 7334-1423-0.

McCraty, R., & Tomasino, D. (2006). Emotional stress, positive emotions, and psychophysio-logical coherence. In B.B. Arnetz& R. Ekman (Eds.), *Stress in health and disease* (pp. 342-365). Weinheim: Wiley-VCH.

Nolan, R.P., Kamath, M. V., Floras, J. S., Stanley, J., Pang, C., Picton, P., & Young, Q. R. (2005). Heart rate variability biofeedback as a behavioral neurocardiac intervention to enhance vagal heart rate control. *American Heart Journal, 149*, 1137.

Pitariu, H.D., Radu, I., & Chraif, M. (2009). Seletion and psychological evaluation of personnel, supplement for *The Journal of Human Resources Psychology*.

Richardson, K. M., & Rothstein, H. R. (2008). Effect of occupational stress management intervention programs: A meta-analysis. *Journal of Occupational Health Psychology, 13*, 69-93. Doi:10.1037/1076-8998.13.1.69.

Sherlin, L., Gevirtz, R., Wyckoff, S., &Muench, F. (2009). Effects of respiratory sinus arrhythmia biofeedback versus passive biofeedback control. *International Journal of Stress Management, 16*, 233-248.

Spielberger, C. D., Gorsuch, R. L., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). *Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press.

Stein, F., & Cutler, S. (2001). *Psychosocial Occupational Therapy A Holistic Approach, (2nd ed.),* NY: *Delmar, Albany*.

Stranks, J. W. (2005). *Stress at work: Management and prevention*. Amsterdam: Elsevier Publishing.

Thompson, M., & Thompson, L. (20030). The neurofeedback book. Where Ridge, CO: Association for Applied Psychophysiology and Biofeedback.