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Stress- Does Brain and Mind Matter- EEG Neurofeedback Training in Alcohol Dependence Syndrome

Reji Mohan[1], Jamuna Rajeshwaren[1]*, Pratima Murthy[2], Nandakumar DN[3] and Thennarasu K[4]

[1]Department of Clinical Psychology, National Institute of Mental Health and Neuroscience, Bangalore, India
[2]Department of Psychiatry, National Institute of Mental Health and Neuroscience, Bangalore, India
[3]Department of Neurochemistry, National Institute of Mental Health and Neuroscience, Bangalore, India
[4]Department of Biostatistics, National Institute of Mental Health and Neuroscience, Bangalore, India

Abstract

Addiction is a complex brain condition characterized by physical and psychological consequences. The role of stress in initiation and maintenance of addiction disorder though reviewed constantly, an adequate treatment modality is yet to be considered. The aim of our study was to find the Effectiveness of Neurofeedback Training (NFT) on perceived stress in Alcohol dependence syndrome (ADS).The objectives of the study were to compare pre - post changes in perceived stress in patients with alcohol dependence with (Treatment Group; TG) and without (Treatment As Usual Group; TAU) Neurofeedback Training.The sample consisted of 40 patients, 20 patients in the Treatment Group and 20 patients in the Treatment as usual group. Both the groups were diagnosed with ADS (ICD-10) recruited from the Centre for Addiction Medicine Unit, Department of Psychiatry, NIMHANS. After screening for inclusion and exclusion criteria, both the groups underwent a pre – post assessment Perceived stress scale. The result showed a significant reduction of stress in Treatment Group compared to Treatment as usual group. The present study highlights the significance of NFT as an effective treatment modality to reduce stress and thereby facilitate abstinence in patients with ADS.

Keywords: Neurofeedback training; Alcohol dependence syndrome; Treatment group; Treatment as usual group; International classification of disorders

Abbrevations: NFT - Neurofeedback Training; ADS - Alcohol dependence syndrome; TG - Treatment Group; TAU - Treatment As Usual Group; ICD - International Classification of Disorders.

Introduction

Chronic alcoholism is characteristically associated with a broad spectrum of clinical co- morbidities. Among this stress, researchers have constantly reviewed mood or affect state. Though, these observations date back to 1945 with Fenichel pointing to an underlying depression as the motive for drug abuse and an extension of the same findings by Rado et al. in 1957 [1,2]. Meanwhile, Conger in 1951 introduced the Tension Reduction Hypothesis (TRH) explaining those who experience stresses or traumas in their life often take alcohol more in order to reduce or avoid unpleasant stresses [3]. Glover [4] reported that the use of drug for coping with overwhelming rage and psychogenic aggression. Khantzian, (1997) with the Self Medication Hypothesis explaining, "traumatized individuals tend to use substances in order to dull or diminish traumatic or painful memories associated with trauma". Studies show that difficulty in coping decreased self-efficacy and less social support are the most consistently predicted relapse among severely stressed abstaining alcoholics [5]. These studies show a strong link between stress and alcohol use, which highlights the need for appropriate management strategies for coping with stress and thereby reducing the relapse rate. The objectives of the present study were to compare pre - post changes in perceived stress in patients with alcohol dependence with (Treatment Group; TG) and without (Treatment As Usual Group; TAU) EEG Neurofeedback Training (NFT).

Subjects and Methods

The study conducted using a cross-sectional, pre post experimental study design at the National Institute of Mental Health & Neurosciences (NIMHANS), Bangalore, India. The study got approval by the Institute's Ethics Committee, and all subjects gave written informed consent.

The sample consisted of 40 patients, 20 patients in the Treatment Group (TG) and 20 patients in the Treatment as usual group (TAU). Both groups were adult males diagnosed with Alcohol Dependence Syndrome (ADS) on ICD-10 criteria, recruited from the Centre for Addiction Medicine Unit, Department of Psychiatry, NIMHANS. The TG, admitted in the Centre for Addiction Medicine, under detoxification, received NFT along with medication. The TAU group, admitted in the centre for addiction medicine, under detoxification, received only medication. After screening for inclusion and exclusion criteria, both the groups underwent a pre – post assessment Perceived stress scale. The selection of samples is by using a purposive sampling with a random assignment.

Inclusion criteria for both groups were age ranging from 18-50 years, male genders, patients who can read and write, right handedness, normal and corrected vision and hearing, and alcohol dependence with or without Nicotine use ranging from 5 to 20 years.

Exclusion criteria for both groups were history of other neurological/ neurosurgical disorder, history of psychiatric disorder other than mild Depressive episode, Score ≥ 20 on Beck Depression Inventory, history of mental retardation and history of polysubstance abuse.

Tools used

Screening Measures used were Socio Demographic Data Sheet, Edinburgh Handedness Inventory (Oldfield, 1971), Beck Depression Inventory (Beck, 1961), Perceived Stress Scale [6].

***Corresponding author:** Jamuna Rajeshwaren, Additional Professor of Clinical Psychology, National Institute of Mental Health and Neuroscience, Bangalore, India, Tel: 091-80-26995181; E-mail: drjamunarajan@gmail.com

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The Perceived Stress Scale is a 10-item self-report questionnaire that measures a person's evaluation of the stressfulness of the situations in the past month of their lives. It is a measure of the degree to which situations in one's life are appraised as stressful. Items were designed to tap how unpredictable, uncontrollable, and overloaded respondents find their lives. The scale also includes a number of direct queries about current levels of experienced stress.

EEG Neurofeedback training (NFT)

EEG Neurofeedback training (NFT) was provided to achieve three main goals such as normalizing brain functioning, restoring brain efficiency, and optimizing daily brain performance. The Pre and Post values on alpha and theta band frequencies recorded at the O1 and O2 locations stipulated by the International 10-20 System are compared between TG and TAU group.

The EEG NFT was carried out in a quiet, dimly lit room. The patient was seated comfortably in front of the Neurofeedback machine. The electrode connected in the O1 (Occipital left) and O2 (Occipital right) position. The alpha theta training protocol for relaxation was selected. The rewards were provided through the visual feedback and an increase in the score which was displayed on the screen. The training is given for 40 minutes of 20 sessions, and the feedback is contingent on the EEG. The session was arranged as 4-5 sessions in a week. The feedback criterion consists of the requirement that the target conditions are sustained for a predetermined time. The target condition is decreasing theta and increasing alpha, also increasing alpha helps with peak performance and improved cognitive efficiency. When the session progresses, the software would adjust threshold, and so the patient learns to produce more alpha waves. Initial sessions are monitored by the examiner by providing verbal feedbacks about their achievements of goals and points.

Statistics

To describe the sample Descriptive Statistics of Mean, Standard Deviation and Percentages were used. Shapiro- Wilk's Test was used for testing Normality. However it was found that the data violated the assumption for normality and therefore, non-parametric tests were used for inferential statistics. Chi –Square test was used for categorical variables. This was used to compare the two groups at baseline to determine where the TG and TAU group are equally representative for certain categorical variables. Mann Whitney U test was used to compare two independent groups (TG and TAU) on continuous variables. Wilcoxon Signed Rank Test was used to compare two dependent groups (e.g.TG pre assessment and TG post assessment; TAU pre assessment and TAU post assessment) on continuous variables. A difference score was calculated for the difference between pre and post assessments for between group comparisons. Friedman Test was used to analyze session to session changes of NFT training.

Exact values were calculated. Asymptotic values were used in Friedman's Tests; *P (<0.05); **P(<0.01)

Results

Socio- demographic details of sample

The sample consisted of 40 male inpatients from the Centre for Addiction Medicine unit, Department of Psychiatry, NIMHANS. The age ranged from 22 - 45 years. The mean age of the total sample was 34. 5 years, indicating the patients were in early or middle adulthood. Among this sample, 21 of them were college educated, and 19 of them were school educated. All the patients could read and write as required for the test performance. The occupation of sample shows 36 patients are employees and 4 were unemployed. The occupation ranged from unskilled workers to professionals. The marital status of the sample shows 20 patients are married; 11 are divorcees and 9 were unmarried. Baseline comparison on demographic variables shows there was no significant difference on age between both groups.

Comparison of Treatment group (TG) and Treatment as usual (TAU) group at base line Family History of Alcohol & Nicotine Dependence (Table 1)

Clinical History of Alcohol and Nicotine Use (Table 2)

Beck Depression Inventory (screening tool) - Table 3

Result showing the difference between TG and TAU on Beck Depression Inventory (BDI)

I Base line Comparison (TG PRE and TAU PRE) of Perceived stress scale- Table 4

Result showing the difference between the TG and TAU on Perceived Stress Scale at baseline. The TG had significantly more severe symptoms of stress on perceived stress scale compared to TAU at base line assessment.

II Within group comparison (TG; PRE - POST and TAU; PRE- POST)- Figure 1-3

Sl. No	Family history	TG N (%)	TAU N (%)	P Value
Alcohol dependence				
1	Present	16(80)	19 (95)	0.34
2	Absent	4(20)	1 (5)	
Nicotine Dependence				
1	Present	14(70)	18(90)	0.19
2	Absent	6(30)	2(10)	

Table 1: Results indicate there was no significant difference between both groups on presence or absence of alcohol & nicotine dependence.

Sl. No	ALCOHOL	TG MEAN ±SD	TAU MEAN ±SD	P VALUE
1	Age of onset	20.25±4.20	19.25±3.21	0.61
2	Age of dependence	24.20±4.59	22.65±3.57	0.31
3	Duration of dependence	10.50±4.09	11.50±4.27	0.49
	NICOTINE			
1	Age of onset	21.07±5.03	20.68±4.95	0.84
2	Age of Dependence	22.86±4.80	22.00±4.79	0.68
3	Duration of Dependence	12.21±4.35	11±4.77	0.79

* Chi-Square Test

Table 2: Results indicate there were no significant differences between both groups on age of onset, age of dependence and duration of dependence of alcohol and nicotine.

Variable	TG MEAN ±SD	TAU MEAN ±SD	P-Value
BDI	13 ± 3.93	12 ± 3.32	0.23

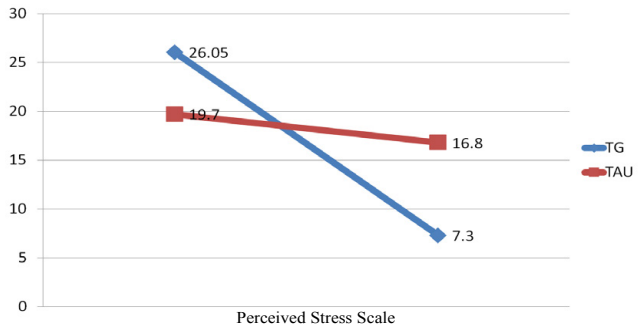
* Chi-Square Test

Table 3: There was no significant difference between both groups on BDI

Variable	TG Mean ± SD	TAU Mean ± SD	P –value	Effect size (Cohen's d)
Perceived stress scale	26.05± 4.9	19.7± 6.3	**0.002***	**3.51**

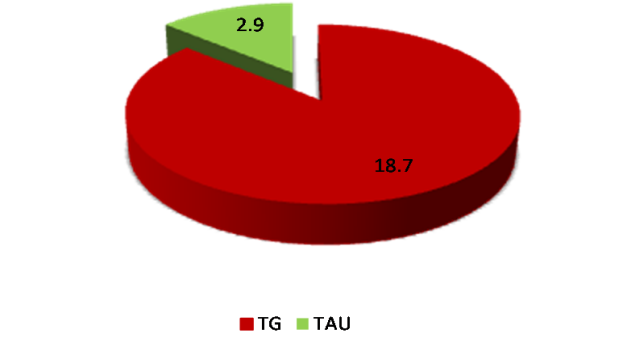
* Mannwhitney U test

Table 4: indicates that was significant difference between both groups on Perceived Stress Scale.



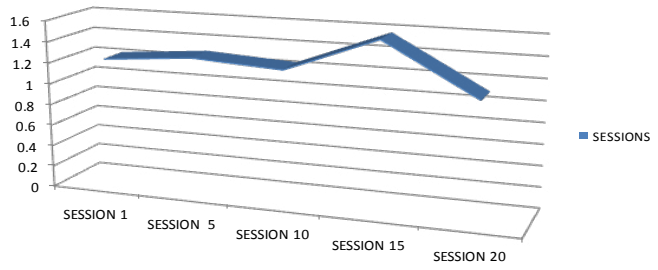
*Wilcoxon Signed Rank Test

Figure 1: There was a significant difference in pre to post assessment Perceived Stress Scale within TG (P = 0.000) and TAU group (P = 0.000). Both groups show statistically significant improvement.



*Mann Whitney U test

Figure 2: There was a significant difference between the TG and TAU pre to post difference scores on Perceived Stress Scale (P= 0.000) . The amount of improvement was greater in TG compared to TAU.



*Friedman's Test.

Figure 3: Graph depicting significant difference in theta/beta ratio at O1 channels (P =0.03)

Results showing difference between TG and TAU group pre to post assessment on Perceived stress scale.

A difference score was calculated to control the difference in baseline comparison of perceived stress.

III Between group comparisons (Difference scores used post-pre assessment)

Result showing difference between the TG pre to post difference scores and TAU pre to post difference scores on Perceived Stress Scale.

EEG-NFT (INTERVENTION) Table 5

Theta/beta ratio at O1 channels

HANNEL-O1 Session No	Theta/Alpha Mean ± SD	P Value	Theta/Beta Mean ± SD	P Value
1st	1.30 ±0.47	0.05	1.22±0.38	**0.03***
5th	1.39±0.82		1.29±0.65	
10th	1.28±0.54		1.24±0.46	
15th	1.55±0.80		1.57±0.68	
20th	1.05±0.46		1.10±0.37	

Comparison of sessions 1, 5,10,15,20 of O1 channel ratios in EEG Neurofeedback Training

*Friedman's Test.

Table 5: indicates there was a significant difference in theta/beta ratio at O1 channels

Discussion

The TG had significantly more severe symptoms of stress (26.05) on perceived stress scale than compared to TAU (19.7) at the baseline assessment. The changes from pre to post assessment scores (difference score) were used to control the baseline variation. (i.e, a new score, was created subtracting baseline scores from post assessment scores). The variations in the baseline were therefore, controlled. An effect size (r) was calculated from the new score (difference score) and the r = 3.51 indicating a large effect size.

The result of the present study indicates a high level of stress in both groups on the baseline assessment. Studies found that an increase in alcohol consumption is associated with different stressors one experiences [5,7]. After NFT, the perceived stress score of TG, 26.05 was significantly reduced to 7.3. The TAU group also showed a significant reduction in stress score from 19.8 to 16.8. However, although there was an improvement in the scores of TAU, the post-assessment scores remained above the cut off. The Scores around 13 are considered as an average in perceived stress scale. The score of TAU show that, the symptoms of stress are still persisting as higher in this group. The findings of the present study reveal NFT can reduce the subjective feeling of stress in patients with alcohol dependence.

The NFT data indicates that there was a significant reduction in theta power in O1 channel from pre to post training. Base line comparisons were made between the 1st, 10th, 15th and 20th sessions to determine if the changes were only within the sessions or whether they are transmitted between the sessions. The findings of the present study showed a significant difference in theta/ beta at O1 channels from 1st to 20th session. The theta/beta ratio is significantly reduced from the 1st to 20th session. A high Beta power in the posterior region can predict relapse in alcoholics [8]. Rangaswamy et al [9] found that an abnormal elevation of theta power in the posterior region of alcoholics is related with deficiency in excitation and inhibition. The present study findings show that NFT has persistent effects in reducing the risk associated with Alcoholism by reducing theta and beta power in the posterior region. The greatest changes are seen between sessions of 15 -20 sessions. However, changes are more prominent in the 20th session. However whether changes takes place after 20th session need to be further explored in the future research.

The patients in the TG and TAU were followed up from post assessment. The follow-up data were collected from clinical interview; medical records as well as from phone calls and has corroborated with the family members. The patients who did not report for the follow up as well as not responded to the telephone calls were not taken for the qualitative analysis. The result shows that all of the 10 patients who were contacted in the TG did not have a relapse. The maximum abstinent period was one year eight months and a minimum of four months based on available data. Two of the 11 patients contacted do not have

a relapse in the TAU group, one patient maintaining abstinent for past 5 months and another patient reported an abstinence of 2 months, were on disulfiram medication to control craving. The maintenance of abstinence in TG well supports NFT works on normalizing brain by reducing stress and thereby reducing the risk of relapse. Its multimodal nature of interaction to overall brain regions, though the training focused on two electrodes sites of O1 and O2 channels and its effectiveness mentioned in above findings show the promising nature of this intervention.

The present study has limitations, firstly, the sample size was small and, so it is difficult to generalize this result to a larger ADS group. Secondly the effect of gender could not be studied as the sample consisted of only male patients and finally, the number of sessions of NFT was limited to the days that the patients were admitted in the ward i.e., 20 sessions. A reduction of stress is important for one to maintain abstinence and this was achieved in the present study findings of TG after EEG-NFT. To conclude, findings of the present study indicate EEG – NFT is effective in reducing stress levels, in Alcohol dependence syndrome.

References

1. Fenichel O (1945) The Psychoanalytic Theory of Neurosis New York: W W Norton.
2. RADO S (1957) Narcotic bondage: a general theory of the dependence on narcotic drugs. Am J Psychiatry 114: 165-170.
3. CONGER JJ (1951) The effects of alcohol on conflict behavior in the albino rat. Q J Stud Alcohol 12: 1-29.
4. Glover E (1956) On the Early Development of Mind. New York: International Universities Press.
5. Perreira KM, Sloan FA (2001) Life events and alcohol consumption among mature adults: a longitudinal analysis. J Stud Alcohol 62: 501-508.
6. Cohen S (1994) Perceived stress scale. Mind Garden Inc.
7. Dawson DA, Grant BF, Ruan WJ (2005) The association between stress and drinking: modifying effects of gender and vulnerability. Alcohol Alcohol 40: 453-460.
8. Rangaswamy M, Porjesz B, Chorlian DB, Wang K, Jones KA, et al. (2002) Beta power in the EEG of alcoholics. Biol Psychiatry 52: 831-842.
9. Rangaswamy M, Porjesz B, Chorlian DB, Choi K, Jones KA, et al. (2003) Theta power in the EEG of alcoholics. Alcohol Clin Exp Res 27: 607-615.