

**EFFICACY OF EEG NEUROFEEDBACK TRAINING ON DEPRESSION: A CLINICAL STUDY****\*Neethu Ial.v, \*\* Jamuna Rajeswaran and \*\*\* John. P.John****\*M.Phil scholar, NIMHANS****\*\*Additional professor, clinical psychology Department, NIMHANS****\*\*\*Additional professor, psychiatry Department, NIMHANS****Abstract**

Depression is one of the most prevalent mood disorders, which also causes significant disruptions in the socio-occupational life of an individual. It is characterized by diverse symptoms including sad mood, loss of interest, and unhappiness, and shows high co morbidity with other brain dysfunction. The aim of the present study was to examine the efficacy of EEG neurofeedback training (NFT) on depressive symptoms in patients with mild to moderate depression. An experimental pre post randomized control group design has been used. A sample of 10 patients with mild to moderate depression was taken purposively and assigned to a treatment group (TG) and treatment as usual group (TAU). Patients in the treatment group has received 20 sessions of NFT at the Occipital 1 and 2 scalp locations at a frequency of 3 days a week along with pharmacotherapy. Patients in the treatment as usual group received only pharmacotherapy. Clinical changes were documented on the Hamilton Depression Rating scale. Results indicated that there was a significant improvement in depressive symptoms both in TG and TAU; however the extend of improvement was double in TG, which could be attributed to NFT.

**EFFICACY OF EEG NEUROFEEDBACK TRAINING ON DEPRESSION: A CLINICAL STUDY**

Depression is one of the most prevalent mood disorders. It is characterized by diverse symptoms including sad mood, loss of interest, and unhappiness, and shows high co morbidity with other brain dysfunction (Currie and Wang, 2004, DeRubeis et al, 2008 ). Epidemiological studies have shown that depression is common throughout the lifespan of an individual, with 20% of the population worldwide experiencing a depressive episode during their lifetime and 2–5% of the population being affected by severe depression (Kessler et al, 2005). Though depression is a mood disorder characterized by disturbance of mood, people with depression may have other symptoms such as lack of interest and pleasure in daily activities, significant weight loss or gain, insomnia or excessive sleeping, lack of energy, inability to concentrate, feelings of worthlessness or excessive guilt and recurrent thoughts of death or suicide.

There are several view points on the etiology and maintenance of depressive disorder such as genetic factors, neurotransmitter disturbances and psychosocial factors such as adverse experiences in childhood, chronic major difficulties undesirable life events, limited social network and low self-esteem. Research evidence suggests that there is often a neurophysiological basis for depression in the form of disturbed brainwave pattern that allows us to identify individuals with a biological predisposition for developing depression. This has been replicated many times in brain map ping research utilizing quantitative electroencephalograms (QEEG) and other forms of neuroimaging studies. These EEG predispositions contributing to the vulnerability of depression in the form of low alpha wave activity on the right brain (Dawson et al, 1992).

Neurofeedback (NFT) has emerged as one such technique aimed at altering processes in the brain to as to enhance certain cognitive functions. It works on brain waves to improve various aspects of functioning. It involves reinforcement of particular EEG frequencies thus increasing or reducing their occurrence. It is used to modify amplitude, frequency and even coherency of one's own brain waves using operant conditioning methods (Thatcher et al, 1999).

In this sensors are placed on the scalp and devices are used to monitor and provide moment- to-moment information that is fed back to the individual about his/ her physiological brain activity for purposes of improving brain functioning (Hammond et al, 2011). Neurofeedback treatments for depression (Baehr, Rosenfeld, & Baehr 1997) appear very promising not only in bringing relief from depression, but in modifying the underlying biological predisposition for becoming depressed. Neurofeedback focuses on retraining the brain, for example, reversing the frontal brainwave asymmetry, with the goal of producing an enduring change that does not require people to remain on medication indefinitely. Training often requires about 15 to 20sessions. It is effective in the sense that it has direct access to the underlying vulnerability which can in turn affect the mood. Four major processes by which NFT effects changes in the brain are (Collura, 2003) are auto regulation, Operant conditioning, Intention to be still, focused and relaxed and Post reinforcement synchronization. Thus, this research is a progress in the direction which will explore NFT's possible benefits in improving both emotional cognitive aspects of depression.

**Aim:**

The aim of the present study was to examine the effect of EEG Neurofeedback on depressive symptoms in patients with mild to moderate depression.

**Hypothesis:**

There will be no significant difference on the pre- post EEG NFT of the TG and the TAU group on depressive symptoms.

**Design:**

An experimental pre post randomized control group design will be used.

**Sample:**

Ten patients diagnosed with mild-moderate depression will be screened and referred by Department of Psychiatry, NIMHANS and 5 each will be randomly assigned to TG and TAU group. The TAU group will include those patients who have been diagnosed as mild to moderate depression and are on routine medication.

**Tools:**

1. Socio- demographic data sheet
2. Mini-international neuropsychiatric interview (MINI Screen) (Sheehan, et al., 1998)
3. Hamilton Depression Rating Scale (HDRS) ( Hamilton, 1960)

**Procedure****Pre training assessment**

Assessment was carried out on all the ten patients using Sociodemographic data sheet, Hamilton depression rating scale.

**Neurofeedback training**

Twenty sessions of NFT were administered for 5 patients in the TG. The patients were given alpha theta training on the O1 (occipital 1) and O2 (occipital 2) channels of Neurofeedback in the 20 sessions. The brain wave pattern were amplified by the machine and gave feedback to the patients by way of visual signals. Each session was of the duration of 20-40 minutes, and 3 sessions per week. Initial 5 sessions were kept at 20 minutes each for the patients to get acquainted to the NFT. The next 15 sessions were of 40 minutes duration.

**Post training assessment**

The post assessment was done for the treatment group on the completion of the 20 sessions of neurofeedback training and for the treatment as usual group one and half months to two months after the pre assessment.

Descriptive statistics were used for the analysis of socio demographic variables. For comparing independent means that is between TG and TAU group Mann Whitney U test was used.

**RESULTS AND DISCUSSION****Comparison of TG and TAU on pre assessment**

The mean age of the patient in TG was  $25.20 \pm 2.28$  and that of TAU group was  $37.60 \pm 5.32$ . There was a significant difference found between the TG and TAU group with regard to age. On statistical analysis no

significant difference was found between the TG and TAU group on the basis of education. Similarly, there was no statistically significant difference between TG and TAU group based on gender.

Table 1.1 age of onset, mean of duration of illness and depression severity

Sample	Age of onset				Duration of illness				depression severity			
	Mean	SD	Median	P value	Mean	SD	Median	P value	Mean	SD	Median	P value
TG (n1=5)	24.40	2.07	.24	0.009*	8.60	3.28	8	1.00	13.00	2.64	12	.525
TAU (n2=5)	36.20	5.49	36		8.40	3.28	6		14.00	2.73	14	
Total	30.30	7.34	28.50		8.50	3.10	7		13.50	2.59	13	

Note: - \* significance at 0.05 level

The age of onset, duration of illness and severity of depression were compared between TG and TAU group. There was a significant difference in age of onset between TG and TAU group. However there is no significant difference between the two groups in terms of duration of illness and depression severity.

#### Comparison of pretest and post test of TG and TAU group for depression.

Table 1.2 (a) - comparison of pre test and post test data on depression for TG (n1=5)

Variable		TG(n=5)			P value
		Mean	SD	Median	
Depression	Pre	13.00	2.64	12	.043*
	Post	2.20	.837	2	

Note: - \* significance at 0.05 level

There is a significant difference between pre and post assessment on level of depression for the TG group.

Table 1.2 (b) - Comparison of pre test and post test data on depression for TAU (n1=5)

n=5)

Variable		TAU (n=5)			P value
		Mean	SD	Median	
Depression	Pre	14.40	3.50	14	.042*
	Post	8.40	2.88	8	

Note: - \* significance at 0.05 level

There is a significant difference between pre and post assessment on level of depression for the TAU group.

The mean age of onset of illness was the second decade for the TG and for TAU it was in the third decade. Literature also shows that the most common time of onset of depression is between the ages of 20 and 30 years, with a later peak between 30 and 40 years. (Kessler et al, 2005). The mean duration of the current episode was  $8.60 \pm 3.28$  for TG,  $8.40 \pm 3.28$  for the TAU and  $8.50 \pm 3.10$  for the total sample. The level of depression for TG and TAU were  $13.00 \pm 2.64$  and  $14 \pm 2.73$  respectively. Hence there is a significant difference in age of onset of illness and there is no significant difference between TG and TAU with regard to mean duration of the episode and level of depression (Table 1.1).

On Hamilton Depression Scale there was a significant improvement in scores for both TG and TAU group. The mean scores for depression were  $13.00 \pm 2.64$  for pre assessment which reduced to  $2.20 \pm .837$  in post assessment for TG. For TAU group, on depression, the pre score was  $14.40 \pm 3.50$  which reduced to  $8.40 \pm 2.88$  in post assessment (Table 1.2-a&b). Though both groups have been significantly improved the extent of improvement is double in TG, which could be attributed to NFT. The study by Lvanya, (2012) that NFT was effective in reducing depressive symptoms also supports this finding. Another study by Baehr, Rosenfeld, & Baehr, (1997) also given similar finding that NFT helps in alleviating symptoms of depression, where 5 female patients and 1 male patient with depression were given alpha symmetry NFT sessions along with their regular treatment. Improvements in the form of reduction in scores on depression scale and MMPI-2 were noted anywhere between 18-36 NFT sessions. 3 of the 6 patients could successfully discontinue their medication after NFT.

In conclusion NFT holds promise as a treatment program for the improvement of depressive symptoms in patients who have received NFT in comparison to patients who received only pharmacotherapy.

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