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The Effect of EEG Biofeedback on Depression and Improve the Quality of Life of Patients With Multiple Sclerosis (MS)

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Abstract

Introduction: Due to some physical and mental symptoms and failure to accept the reality, Multiple Sclerosis (MS) patients suffer from negative mood disorders and trauma, and this would have negative effects on their quality of life. This study aimed to investigate the effectiveness of EEG biofeedback on MS patients' quality of life and depression symptoms.

Methods: The design is Quasi-experimental with pre-test, post-test and follow-up. The sample, 20 patients in experiment (10) and control (10) groups, is all of the MS patients of Yazd that have a record in clinics or MS Association, and is chosen by convenience sampling. Before the treatment started, patients had filled the HADS depression scale and MSQOL-54 quality of life questionnaire, then, in the post-test and follow-up stages, these evaluations were done again. The treatment lasted for 15 sessions, two sessions per week, and the follow-up was done three months after the post-test. The data obtained from the questionnaire were analyzed by SPSS17 software using descriptive tests (mean and standard deviation) and inferential tests (covariance analysis).

Results: Research findings shows that EEG biofeedback decreases the depression level and increases the quality of life of patients with MS.

Conclusions: MS results in many symptoms, and its sufferers may need a mental rehabilitation in future, therefore, EEG biofeedback can be applied by therapists as a complementary therapy in clinics and therapeutic centers.

INTRODUCTION

Multiple sclerosis (MS) is a potentially life-changing immune mediated disease of the central nervous system. It is the most commonly acquired neurological disorder affecting young adults of reproductive age with an approximately 3:1 female to male ratio. MS significantly impacts the lives of individuals with the disease and their families. Recent advances in the understanding of the immunopathology and management of MS have made this field of care dynamic and challenging [1].

Mood swings are characterized by unexpected and sudden shifts in mood that are uncharacteristic of the person's usual mood. A symptom that is another common aspect of MS is its effect on mood dysfunction, which brings on depression or elation resulting in unexpected or inappropriate mood swings [2].

The course of MS is unpredictable. Most people having a relapsing- remitting course marked by periodic attacks or exacerbations that only generally partially remit. The major depressive disorder is the most common psychiatric disorder in these patients. This patients suffering of persistent feelings of sadness, hopelessness about the future, percep-

tions about theirs disability and disability, persistent mental preoccupation with negative thoughts that they are adverse consequences of depression, even they can cause extreme behaviors such as suicide attempts. Depression can discourage individuals from pursuing medications for illness and increase symptoms of Illness. Furthermore, depression may also have an adverse effect on process of adjusting and adapting to new conditions [3].

It is recognized that patients with multiple sclerosis have a high lifetime risk for major depression. Major depression is common in MS patients and estimations show that 50/0 of MS patients suffer from major depression. Major depression often occurs in MS patients aged 18 to 45 years and most commonly associated with suicidal ideation [4-6]. The results indicate that drugs (including interferon) can accelerates the depression in MS.

Complications of MS in patients has led to a decrease in performance and thus the quality of their role and status of the job and ultimately MS might negative effect on the quality of life of patients [1]. On the other hand, multiple sclerosis disease causes loss of individual autonomy and social well-being and leads to reduce restrictions on the practice of sustainable quality of life [7]. Research has also shown that increased rates of depression, psychological distress and anxiety that associated with reduction social function and quality of life [8]. Quality of life (QoL) has presently a firmly established position as an important endpoint in medical care [9].

Neurofeedback (NF) refers to an operant conditioning paradigm where participants can learn voluntary control of distinct parameters of their electrical brain activity as measured by the electroencephalogram [10]. EEG learned self-regulation of specific EEG frequency components has proven to be of considerable value in clinical settings with applications in various. Additionally, more recent research focused on healthy individuals providing evidence that subjects are able to gain some control over different EEG components and thereby increase performance levels [11]. Because neurofeedback training is a novel therapeutic approach and its effectiveness in the treatment of various disorders, we need more research. This study is also in line with the need to evaluate the effectiveness of neurofeedback in reducing depression in patients with multiple sclerosis.

Quality of life in patients with MS is significantly lesser than chronic diseases such as from other patients with rheumatoid arthritis, inflammatory bowel disease, diabetes and epilepsy. Because of the chronic, recurrent, and disability in physical activity of the patient, the disease can have different degrees of influence on the psychosocial aspects [12].

The aim of this study is to investigate the effectiveness of EEG biofeedback on MS patients' quality of life and depression symptoms in Yazd.

METHODS

The method of such study is experimental. Also study design is as pre testing, post testing and follow up with control group. The statistical study consisted of patients with multiple sclerosis that they have file in clinical and MS community in Yazd in 2013-2014.

Inclusion criteria: Have clinically diagnosed following the McDonald et al. were in a stable phase of the disease, without relapsing in the last 2 months. Participants ages above 18 years old and also experienced depression. The exclusion criteria: acute relapse of MS within the last month, the presence of additional neurological or psychiatric disorders, epilepsy and other chronic diseases.

The Hospital Anxiety and Depression Scale (HADS) [13] consists of 14 items; 7 items measure the severity of depression and 7 items measure the severity of anxiety. Hospital Anxiety and Depression Scale (HADS) HADS was applied to assess the presence and severity of depression and anxiety. This is a 14-item self report screening scale developed to detect the presence of anxiety and depression symptoms in the setting of a medical non psychiatric outpatient clinic [10]. The HADS scores seven anxiety symptoms and seven depression symptoms, and each item presents a four-point Likert type. The maximum score for both scales is 21points for depression and anxiety each one. Scores adding up to 0–7 are considered normal, 8–10 indicate mild anxiety and/or depression and _11 indicates clinically relevant anxiety and/or depression. The Spanish version was validated by Herrero et al. [11]. This version has a Cronbach's alpha coefficient of 0.90 for the full scale, 0.84 for the depression subscale and 0.85 for the anxiety subscale. The cut-off point for depressive disorder is 5 (sensitivity 77.8%; specificity 80.9%), and for anxiety disorder is 8 (sensitivity 89%; specificity 77.2%).

Multiple Sclerosis Quality of Life (MSQOL)-54 Instrument: The MSQOL-54 is a multi dimensional health-related quality of life measure that combines both generic and MS-specific items into a single instrument. The developers utilized the SF-36 as the generic component to which 18 items were added to tap MS-specific issues such as fatigue, cognitive function, etc. This 54-item instrument generates 12 subscales along with two summary scores, and two additional single-item measures. The subscales are: physical function, role limitations-physical, role limit ations-emotional, pain, emotional well-being, energy, health perceptions, social function, cognitive function, health distress, overall quality of life, and sexual function. MSQOL-54 scale scores were assembled using the Likert method for summed ratings and the raw scores were linearly transformed into 0-100 scales: the higher the transformed score, the better the patient's HRQOL [14].

Intervention: Neurofeedback treatment to be run for 15 40-minute sessions twice a week, individually. The main tool used Neurofeedback was biography device manufacturer thought technology company in Canada. The system is connected to the computer with the USB cable and with using EEG sensors, information collected from the surface of the body is transferred to the computer monitor. This information is viewed, analyzed, and recorded. Intervention was conducted by the specialist trained in psychology clinic.

Implemented protocols for subjects:

1- Reduction θ (4-8) and α (8-12), increase β (15-18), on F3 for 10 min.

2- Reduction θ (4-8) and α (8-12), increase smr (15-18) on F3 for 10 min.

3- Reduction Δ (0-4) and β (23-35), increase α (8-12) on Fz for 20 min

4- Threshold of meeting 1-5(25-75-25), threshold of meeting 6-10 (30-70-30), threshold of meeting 11-15(35-65-35).

After of the end treatment, both experimental and control groups after three months, re-evaluated, the data were analyzed statistically.

RESULTS

Quality of life score after intervention in the treatment group and control group respectively were 52.1 and 33.9. This significant difference continued to follow-up (49.8 vs 32).
According ANCOVA test was conducted, signification levels is lesser than 0.05, so assuming an effective therapy will be accepted on quality of life after intervention and follow-up in MS patients.
According ANCOVA test, signification levels is lesser than 0.05, Therefore, the intervention was effective in reducing depression after intervention and follow-up in MS patients.

Table 1: Statistical Information Related to the Pre-Test, Post-Test and Follow-up Quality of Life for the Experiment and Control Groups (n = 10)

	R	Min	Max	Mean ± SD	Variance
Pre-test					
Control	63.45	12.00	75.45	37.4180 ± 21.13225	446.572
Experiment	64.25	12.35	76.60	37.6500 ± 21.05398	443.270
Post-Test					
Control	57.31	12.00	69.31	33.9040 ± 20.47579	419.258
Experiment	63.71	25.54	89.25	52.1350 ± 20.20604	408.284
Follow-up					
Control	55.35	11.20	66.55	32.0850 ± 20.39946	416.138
Experiment	53.12	24.70	77.82	49.8550 ± 18.68950	349.297

Table 2: Statistical Information Related to the Pre-Test, Post-Test and Follow-up Depression for the Experiment and Control Groups (n = 10)

	R	Min	Max	Mean ± SD	Variance
Pre-Test					
Experiment	61.39	15.49	76.88	38.047 ± 18.27	334.00
Control	8.00	10.00	18.00	14.40 ± 3.02	9.156
Post-Test					
Experiment	68.07	17.41	85.48	44.14 ± 21.34	455.76
Control	13.00	7.00	20.00	14.80 ± 3.64	13.28
Follow-up					
Experiment	61.17	20.11	81.28	41.485 ± 18.15	329.59
Control	6.00	14.00	20.00	17.400 ± 1.89	3.60

Table 3: Levine's Test for Quality of Life and Depression Post-Test and Follow-Up Scores the Experiment and Control Groups

	Fisher Test	Df1	Df2	Sig
Quality Life				
Post-Test	0.019	1	18	0.892
Follow-up	0.127	1	18	0.725
Depression				
Post-Test	1.621	1	18	0.219
Follow-up	0.070	1	18	0.795

According to the Table 3, results of test for quality of variance showed the (H_0) hypothesis is not rejected for all variables.

Table 4: Tests of Between-Group Variable: The Quality of Life Post-Test

	Type Third Sum Of Squares	df	Mean Square	Statistics for Fisher	Sig	Eta Square
The Modified Model	3153.552a	2	1576.776	4.500	0.027	0.346
Reciprocal	3184.159	1	3184.159	9.088	0.008	0.348
Post-Test	1491.705	1	1491.705	4.258	0.055	0.200
Group	1643.588	1	1643.588	4.691	0.045	0.216
Error	5956.173	17	350.363	-	-	-
Total	46123.272	20	-	-	-	-
Total Corrected	9109.724	19	-	-	-	-

According above table and ANCOVA test was conducted, signification levels is lesser than 0.05, so H_0 rejected and assuming an effective therapy will be accepted on quality of life after intervention.

Table 5: Tests of Between-Group Variable: The Quality of Life Follow-up Scores

	Type Third Sum of Squares	df	Mean Square	Statistics for Fisher	Sig	Eta Square
The Modified Model	2681.259a	2	1340.630	3.939	0.039	0.317
Reciprocal	3237.534	1	3237.534	9.511	0.007	0.359
Post-Test	1102.395	1	1102.395	3.239	0.090	0.160
Group	1563.553	1	1563.553	4.594	0.047	0.213
Error	5786.523	17	340.384	-	-	-
Total	42038.600	20	-	-	-	-
Total Corrected	8467.782	19	-	-	-	-

According above table and ANCOVA test was conducted, signification levels is lesser than 0.05, so H_0 rejected and assuming an effective therapy will be accepted on quality of life after follow-up.

Table 6: Tests of Between-Group Variable: The Depression Post-Test Scores

	Type Third Sum of Squares	df	Mean Square	Statistics for Fisher	Sig	Eta Square
The Modified Model	169.849a	2	84.924	12.995	0.000	0.605
Reciprocal	8.377	1	8.377	1.282	0.273	0.070
Post-Test	59.399	1	59.399	9.089	0.008	0.348
Group	113.362	1	113.362	17.346	0.001	0.505
Error	111.101	17	6.535	-	-	-
Total	3381.000	20	-	-	-	-
Total Corrected	280.950	19	-	-	-	-

According above table and ANCOVA test was conducted, signification levels is lesser than 0.05, so H_0 rejected and assuming an effective therapy will be accepted on depression after intervention.

Table 7: Tests of Between-Group Variable: The Depression Follow-up Scores

	Type Third Sum of Squares	df	Mean Square	Statistics for Fisher	Sig	Eta Square
The Modified Model	247.941a	2	123.970	45.216	.000	0.842
Reciprocal	35.325	1	35.325	12.884	0.002	0.431
Post-Test	36.691	1	36.691	13.382	0.002	0.440
Group	214.376	1	214.376	78.190	0.000	0.821
Error	46.609	17	2.742	-	-	-
Total	4299.000	20	-	-	-	-
Total Corrected	294.550	19	-	-	-	-

According above table and ANCOVA test was conducted, signification levels is lesser than 0.05, so H_0 rejected and assuming an effective therapy will be accepted on depression after follow-up.

DISCUSSION

The effectiveness of neurofeedback treatment of depression has been reported in different groups [15, 16]. Neurofeedback treatment used for various aspects of MS patients and its efficacy has been reported [17, 18].

According to the investigation and the data obtained from the questionnaire, these results were as follows:

EEG feedback therapy on quality of life in patients with multiple sclerosis in post-test and follow up Phase was effective. These findings indirectly coordinated with Choobforoushzadeh et al. [19], Pampa Reddy et al. [20], Hammond [21], Hammond [22]. Several studies regarding the effectiveness of EEG feedback therapy was conducted on patients with MS. However, in this topic still has not been studied in Iran. One of the main reasons to explain the effectiveness of EEG feedback to improve the quality of life in patients with MS is the effectiveness of EEG feedback on the mental aspect of quality of life. Mental status in patients with MS Recovered by reducing depression and mood enhancement and followed by reduction of the limitations of the disease can lead to improving the quality of life in these patients.

The results showed that depression in patients with multiple sclerosis in the experimental group than in the intervention and follow-up phase is lesser than depression in patients with MS in control group. Therefore it can be concluded that EEG feedback therapy leads to reduction depression in patients in the intervention and follow-up phase. The findings of the study are consisted to Hammond [22] and Beer et al. [23].

In explaining the effectiveness of EEG feedback in reducing depression in patients with MS, we can say Statements with respect to the research, the balance of alpha wave is created on both sides of the frontal lobe decreases.

CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

"Reza Bidaki carried out supervision stages of project. Fariba Sepehri carried out collect samples. Rezvan Sadr Mohammadi participated in the design of the study and performed the statistical analysis. Omid Kamali conceived of the study, and participated in its design and coordination and helped to draft the manuscript. Mojtaba Babaei Zarch as well Hamid Mirhoseini wrote the final manuscript. All authors read and approved the final manuscript."

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REFERENCES

1. Halper J. Advanced concepts in multiple sclerosis nursing care. New York: Demos Medical Publishing; 2007.
2. Farrell P. Anxiety, Depression, Mood swings, and Mulltiple sclerosis. New York: Demos Medical Publishing; 2011.
3. Levenson L. Depression. Philadelphia: ACP(American College of Physicians); 2002.
4. Feinstein A. An examination of suicidal intent in patients with multiple sclerosis. Neurology. 2002;59(5):674-8. PMID: 12221156
5. Feinstein A. The neuropsychiatry of multiple sclerosis. Can J Psychiatry. 2004;49(3):157-63. DOI: 10.1177/070674370404900302 PMID: 15101497
6. Stuke H, Hanken K, Hirsch J, Klein J, Wittig F, Kastrup A, et al. Cross-Sectional and Longitudinal Relationships between Depressive Symptoms and Brain Atrophy in MS Patients. Front Hum Neurosci. 2016;10:622. DOI: 10.3389/fnhum.2016.00622 PMID: 28018194
7. Kesselring J, Beer S. Symptomatic therapy and neurorehabilitation in multiple sclerosis. Lancet Neurol. 2005;4(10):643-52. DOI: 10.1016/S1474-4422(05)70193-9 PMID: 16168933
8. Janssens AC, van Doorn PA, de Boer JB, van der Meche FG, Passchier J, Hintzen RQ. Impact of recently diagnosed multiple sclerosis on quality of life, anxiety, depression and distress of patients and partners. Acta Neurol Scand. 2003;108(6):389-95. PMID: 14616290
9. Papuc E, Stelmasiak Z. Factors predicting quality of life in a group of Polish subjects with multiple sclerosis: accounting for functional state, socio-demographic and clinical factors. Clin Neurol Neurosurg. 2012;114(4):341-6. DOI: 10.1016/j.clineuro.2011.11.012 PMID: 22137087
10. Vernon DJ. Can neurofeedback training enhance performance? An evaluation of the evidence with implications for future research. Appl Psychophysiol Biofeedback. 2005;30(4):347-64. DOI: 10.1007/s10484-005-8421-4 PMID: 16385423
11. Levesque J, Beauregard M, Mensour B. Effect of neurofeedback training on the neural substrates of selective attention in children with attention-deficit/hyperactivity disorder: a functional magnetic resonance imaging study. Neurosci Lett. 2006;394(3):216-21. DOI: 10.1016/j.neulet.2005.10.100 PMID: 16343769
12. Sadrarhami N, Atarod S, Amanat S. Attitude of patients with multiple sclerosis towards the impacts of the disease on their social and activities. Semmi Ann J Res Behav Sci. 2008;2(12).
13. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. Acta Psychiatr Scand. 1983;67(6):361-70. PMID: 6880820
14. McHorney CA, Ware JE, Jr., Raczek AE. The MOS 36-Item Short-Form Health Survey (SF-36): II. Psychometric and clinical tests of validity in measuring physical and mental health constructs. Med Care. 1993;31(3):247-63. PMID: 8450681
15. Sacchet MD, Gotlib IH. Neurofeedback training for major depressive disorder: recent developments and future directions. Expert Rev Neurother. 2016;16(9):1003-5. DOI: 10.1080/14737175.2016.1199959 PMID: 27310296
16. Cheon EJ, Koo BH, Choi JH. The Efficacy of Neurofeedback in Patients with Major Depressive Disorder: An Open Labeled Prospective Study. Appl Psychophysiol Biofeedback. 2016;41(1):103-10. DOI: 10.1007/s10484-015-9315-8 PMID: 26392114
17. Dobrushina OR, Varako NA, Kovyazina MS, Zinchenko YP. Combination of Neurofeedback and cognitive training in attention deficit due to multiple sclerosis. Int J Psychophysiol. 2016(108):118. DOI: 10.1016/j.ijpsycho.2016.07.351
18. Jensen MP, Gianas A, George HR, Sherlin LH, Kraft GH, Ehde DM. Use of Neurofeedback to Enhance Response to Hypnotic Analgesia in Individuals With Multiple Sclerosis. Int J Clin Exp Hypn. 2016;64(1):1-23. DOI: 10.1080/00207144.2015.1099400 PMID: 26599991
19. Choobforoushzadeh A, Neshat-Doost HT, Molavi H, Abedi MR. Effect of neurofeedback training on depression and fatigue in patients with multiple sclerosis. Appl Psychophysiol Biofeedback. 2015;40(1):1-8. DOI: 10.1007/s10484-014-9267-4 PMID: 25362584
20. Reddy RP, Rajeswaran J, Bhagavatula ID, Kandavel T. Silent Epidemic: The Effects of Neurofeedback on Quality-of-Life. Indian J Psychol Med. 2014;36(1):40-4. DOI: 10.4103/0253-7176.127246 PMID: 24701008
21. Hammond DC. Neurofeedback with anxiety and affective disorders. Child Adol Psychiatr Clin North Am. 2005;14(1):105-23.
22. Hammond DC. Treatment of chronic fatigue with neurofeedback and self-hypnosis. NeuroRehabilitation. 2001;16(4):295-300. PMID: 11790917
23. Hammond DC. Neurofeedback treatment of depression with the Roshi. J Neuro. 2000;4(2):45-56. DOI: 10.1300/J184v04n02_06