

**ORIGINAL RESEARCH****The effect of neurofeedback on the quality of life of patients with tinnitus referred to the Isfahan hearing aid center**

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**Introduction:**

Tinnitus is one of the common and chronic problems of the ear and nose. It has various causes and in spite of various treatments, it decreases the quality of life of patients. Neurofeedback is a method that has been providing observation and recording of brain waves and it is effective in controlling brain activity and self-awareness in various diseases such as depression, hyperactivity and tinnitus, and etc. The aim of this study was to evaluate the effect of neurofeedback on improving the quality of life of patients with tinnitus referring to Isfahan Auditory Center.

**Methods:**

The Iranian version of the quality of life questionnaire, which is presented by the WHO, was given to patients with tinnitus who referred to Isfahan Auditory Center for treatment of neurofeedback. The questionnaires were completed by the patients before starting treatment and again after the completion of the course. During the study, people aged 20-70 years without psychotics and echoes of pathologic and etiologic causes were included in the study. The scores were calculated based on QOL questionnaire and, with other demographic information, and entered into the SPSS software for analysis.

**Results:**

Thirty-five patients were enrolled in the study. The mean of ages was  $37.28 \pm 11.20$  years, 48.57% were male and 51.43% were female. Eleven patients (31.42%) have one-way tinnitus. Ten patients were ill for less than 6 months and 11 patients were ill over 2 years, and in 18 patients (51.42%), hearing loss was observed. The mean QOL score in patients, before treatment, was 74.8, and it was 99 after treatment; so, there was 32.33% increase in scores. This increase was significant ( $p < 0.01$ ). However, there is no significant relationship between gender, age and duration of the disease with improving quality of life ( $p > 0.05$ ). There is only a significant relationship between the number of treatment sessions and the improvement of quality of life ( $p < 0.05$ ) and increased QOL rate by 25.31%.

**Conclusion:**

Finally, it can be concluded that tinnitus has a significant effect on the quality of life of patients, and the neurofeedback has been able to increase the quality of life of patients, but this relationship is not related to gender, age, and other variables except the number of treatment sessions.

**Keywords:**

Tinnitus, Neurofeedback, Quality of life.

**Introduction:**

According to statistics provided by developed countries, tinnitus is one of the most common causes for the referral of patients to hearing aid clinic. The root of Latin word tinnitus is taken from "tinnire" that means "ringing" and hearing the sound without its external source. Tinnitus is categorized as objective and subjective. Objective tinnitus is heard by the examiner and other people, unlike subjective type and usually has a structural and vascular cause.

The common causes of tinnitus include audio pollution and trauma, some medications and chemicals, mental and psychiatry stressors. Some types of tinnitus have a neurological or functional origin that in these cases, there is usually no cause for it. Although tinnitus physiology is still not well-known, the damage to the hairy cells in the scrotum can lead to the loss of the neural cells in the auditory system and, consequently, the reorganization of the cortical brain function map. In other words, the ears of these patients can be sensitive to surrounding frequencies, due to the loss of cortical neurons from certain frequencies, and as a result of tinnitus. The study of the regions and patterns of hearing in the brain of affected people using magnetic encephalography and electroencephalography has shown that loss of strength in the range of alpha waves and an increase in the range of delta waves, especially in temporal areas, is associated with an increase in the incidence of tinnitus and other neurological disorders.

A neurofeedback is a type of biofeedback that results in self-control of the brain's function, which is also referred to as nerve feedback, by detecting and measuring brain waves and generating a recurrent signal. This device is one of the most advanced modern medical devices. Every moment in the brain of each of us, there are many waves and numerous physiological fires, without us having an awareness and understanding of how their function. The physiological processes in our brain and brain waves constantly affect our behavior, thoughts, performance and our physical and mental health without any interference with our consciousness. Indeed, the neurofeedback is a human effort to improve performance and self-control over involuntary actions and brain waves and is effective in the treatment of various diseases

such as depression, hyperactivity, anxiety, and epilepsy.

Quality of life has several definitions, and nowadays it is an important component along with other aspects of patient treatment. According to the World Health Organization, the quality of life, is the understanding of individuals from their position in life, in terms of culture, value system in which they live, their goals, expectations, and priorities. Therefore, it is completely individual and not visible by others and is based on the perception of individuals from different aspects of their lives. The World Health Organization's brief Quality of Life Scale (WHOQOL-BREF) currently measures four areas of physical, psychological, social and environmental health, and its standardized Iranian version is an excellent illustration of the quality of life.

Tinnitus is a distressing illness that can lead to major problems, including insomnia, disturbance in concentration, and loss of quality of life. On the other hand, mental tensions can exacerbate tinnitus. Tinnitus for the loss of quality of life is the same as chronic pain. Also, the relationship between tinnitus and the incidence of depression and mental disorders has been confirmed.

The purpose of this study was to investigate the effect of neurofeedback as a new method in the treatment of tinnitus in patients and their impact on improving the quality of life of patients referred to the Isfahan Audiology Clinic.

**Method:**

This cross-sectional study was conducted on a WHO standard quality of life questionnaire, which was given to patients with tinnitus who referred to the hearing aid center of Isfahan for treatment of neurofeedback. Questionnaires were completed by patients before the first session of neurofeedback. Then the treatment was performed with the number of specific sessions. After completing the sessions, the questionnaire was completed again by patients.

In this way, 35 patients were enrolled in the study according to the criteria for inclusion in the study, which included idiopathic tinnitus (and irreversible reasons such as audio traumas) and aged 20 to 70 years. Exclusion criteria included psychotic problems and psychological and ectopic causes of tinnitus that were considered in the selected patients

for treatment with neurofeedback, and thus, patients did not have any withdrawal criteria. Patients responded to each question and calculated based on the score of the questionnaire QOL scores.

The number of patient sessions varied according to the conditions of each patient and varied from 8 to 16 sessions. Also, in addition to the questionnaire, the duration of the disease, one-way or two-way, and accompanied by hearing loss and other demographic information were extracted. Finally, all the data were entered into the SPSS software.

The statistical results were reported as percentages and the non-parametric K2 test was used for the significance of the percentages in SPSS software. Also, for correlation of independent variables with response variable, K2 and logistic regression were used.

**Results:**

Of the 35 patients with tinnitus who were referred for treatment with neurofeedback, demographic data were as follows, 48.57% were male and 51.43% were female. The mean ages of patients were 37.28 ± 11.2.

Demographic information		
Gender		
	frequency	Percentage
Female	18	51.43%
male	17	48.57%
total	35	100%
Age		
ages	Frequency (%)	Descriptive information
40 20	(%60) 21	mean±SD: 37.28±11.20
60 40	(%37.14) 13	Max: 62
60<	(%2.85) 1	Min: 20

51.42% of patients had hearing loss at the same time as tinnitus. Also, the duration of tinnitus was 28.57% of patients less than 6

months and 31.42% of patients were more than 2 years old.

Hearing condition	Frequency	Score treatment before	Score treatment after	Percentage of recovery
Along with hearing loss	%40	75.28	98.76	31.19%
No hearing loss	%60	74.21	99.5	34.07%

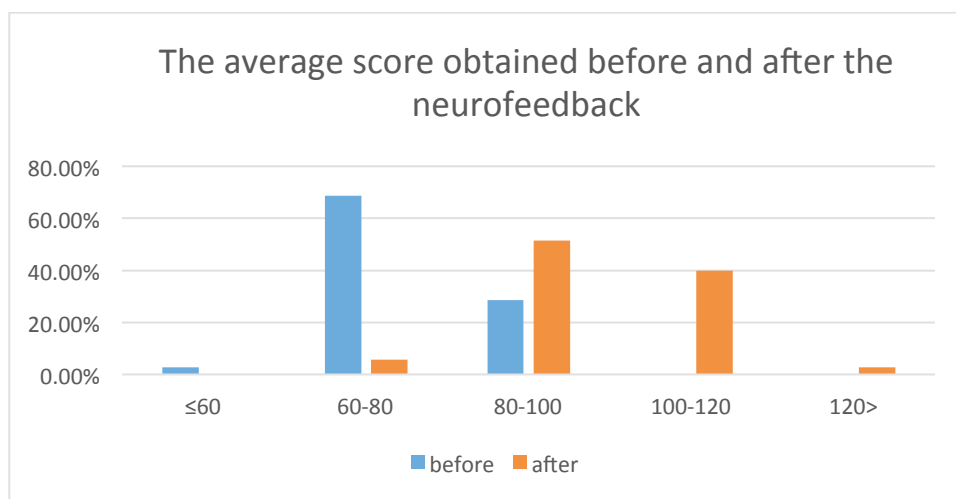
31.4% of patients had one-way tinnitus and 68.6% had bilateral tinnitus. The score before and after treatment of patients in one-way or

two-way tinnitus groups according to the following table and there was no significant difference (p> 0.05).

Tinnitus status	Frequency	Score before treatment	Score after treatment	Percentage of recovery
One way	%31.4	76	100.63	32.40%
two way (bilateral tinnitus)	%68.6	74.33	98.33	32.28%

By examining 35 patients, 82.85% of the patients received more than 10 sessions of neurofeedback. The mean QOL score in the patients before the start of treatment was 79

and after treatment, it reached 99 that showed a 25.31% increase in scoring. This difference was statistically significant (p <0.05).



The mean tinnitus rate is 21.67 months and is according to the following table. In the studied patients, the improvement of the quality of life in the group of patients aged 48 to 72 months

was increased by 33.60%, and in the group less than 6 months, with the increase of 30.44%, has the slightest increase.

Rate of catch (month)	Frequency	Descriptive information	Score before treatment	Score after treatment
<6	28.57%	Mean ± SD : 21.67±20.46 max: 72 min: 1.5	72.6	94.7
12 6	25.71%		79.5	103.9
24 12	17.14%		76.5	103.3
48 24	14.28%		69.4	93.6
72 48	14.28%		74.4	99.4

Based on the table below, the number of treatment sessions was grouped into two groups and it is observed that the highest

percentage of recovery is related to the group with the number of sessions from 12 to 16 sessions.

Classification of treatment sessions (days)	Frequency	Descriptive information	Score before treatment	Score after treatment	Percentage of recovery
12 8	88.57%	mean±SD: 10.51±1.73 max: 16 min: 8	74.87	98.67	31.78%
16 12	11.43%		74.75	102	36.45%

The highest increase in recovery was in the age group of 40 to 60 years and the lowest was in the age group above 60 years. Improved

quality of life in men was also higher, but no significant difference was observed between the two groups.

The percentage of recovery in the studied age group			
Rate of catch (month)	Score before treatment	Score after treatment	Percentage of recovery
40 20	75.23	98.38	30.77%
60 40	73.92	99.84	35.06%
60<	79	103	30.37%

Table of percentages of recovery in different patient gender			
gender	Score before treatment	Score after treatment	Percentage of recovery
female	74.5	98.16	31.75%
male	75.23	100	32.92%

**Discussion:**

Tinnitus displays are very diverse and various methods are used to treat it. However, different therapeutic techniques in many cases have no effect on definitive tinnitus treatment and cause many problems for patients and, in prolonged and severe cases, cause loss of function and reduce the quality of life of patients.

In various studies, the effect of neurofeedback has been demonstrated in the treatment of many disorders such as hyperactivity and anxiety and epilepsy, and etc.

In the context of tinnitus, especially in idiopathic cases, due to alterations in brain wave levels, especially alpha and delta, neurofeedback has been able to reduce the tone of the ear by making self-awareness and changing brain waves through self-developed processes, and various studies have proved the effectiveness of this method.

In this study of 35 patients with unknown tinnitus, evaluation of QOL completed by patients showed a 32.33% increase in the level of quality of life in patients, which can be indicative of the response rate to neurofeedback treatment. In the study, there was no significant relationship between age, sex, duration of tinnitus, hearing loss, and change in the quality of life score in patients, and only those who had received more than 10

sessions of treatment with neurofeedback had a significant increase in quality improvement of their life.

**Conclusion:**

Nowadays, improving the quality of life is very important in the treatment of chronic diseases. According to the findings of this study, it seems that tinnitus treatment with neurofeedback has been effective in increasing the quality of life of these patients, especially in idiopathic cases. This causes mental and physical problems and a lot of functional dysfunction for the patient.

Due to various reasons such as inadequate knowledge, a relatively high cost in our country and especially in Isfahan, the number of patients referred for treatment with neurofeedback is limited in various areas, especially tinnitus, and this explains the need for further development of these interventions and making patients more aware of new therapies such as neurofeedback and biofeedback.

These findings suggest that neurofeedback treatment can be used as a selective intervention and complementary pharmacotherapies and psychological treatments for patients with tinnitus and can improve the quality of life of patients.

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