



Research Paper

The Effect of Long-term Biofeedback Therapy on Depression of Elderly Stroke Patients



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ABSTRACT

Background and Objectives: Depression is a common problem after stroke, with a high prevalence. Multiple studies have suggested that biofeedback therapy can effectively treat depression without causing side effects. This research aims to investigate the long-term impact of biofeedback therapy on depression in stroke survivors.

Methods: A quasi-experimental study was conducted with 40 stroke patients who were divided into a rehabilitation control group and a rehabilitation group that underwent long biofeedback electromyography exercises. All patients were assessed for their level of depression at the start of the study and again after two years of treatment, after completing occupational therapy sessions with and without biofeedback intervention. Statistical analysis was performed using paired t-tests and correlated t-tests with a significance level ($P \leq 0.05$).

Results: In both control and intervention groups, no significant differences were observed in the level of depression between the pre-test and post-test stages. However, a crucial difference was observed between the intervention and control groups after using biofeedback. The average depression in patients who used long-term biofeedback decreased after two years compared to the control group ($P \leq 0.05$).

Conclusion: Long-term utilization of biofeedback therapy impacts the depression levels of stroke patients. This method is highly recommended as a complementary approach to conventional rehabilitation.

Keywords: Biofeedback, Depression, Stroke, Aging



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↑ *What is “already known” in this topic:*

Biofeedback therapy positively impacts the performance and recovery of stroke patients in physical therapy and can serve as a complementary treatment method.

→ *What this article adds:*

Extended use of biofeedback techniques, much like their application in short-term interventions, can significantly enhance the mental well-being of elderly individuals who have experienced a stroke. This approach not only helps to improve their psychological state but also fosters better emotional regulation, reduces anxiety, and promotes a sense of control over their health. By engaging in biofeedback, these patients can gain valuable insights into their physiological responses, which can lead to improved coping strategies and overall quality of life as they navigate the challenges of recovery.

Introduction

Stroke is a major public health issue with a significant impact worldwide. According to the [World Health Organization \(WHO\)](#), it is ranked as the third most common cause of death and the leading cause of disability worldwide [1]. Every year, around two million people experience the life-altering effects of a stroke [2].

After a stroke, many individuals face significant challenges with their sensory perception, physical mobility, and emotional well-being, leading to limitations in their daily routines [2]. And a large number of individuals often experience depression. This mental health condition is widespread and affects a significant portion of stroke survivors [3]. Commonly used methods for clinical treatment are pharmacological methods that involve the prescription and use of medications, psychosocial stroke-focused therapy that aims to change unhealthy behaviors while encouraging the development of positive ones, cognitive behavior therapy (CBT), neuromodulation, etc. [4]. When considering these approaches, it's essential to keep in mind that they come with certain limitations, such as lack of access to a psychologist, CBT more over rehabilitation sessions or side effects that may occur with drug use, as well as the necessity to consider the long-term results of the treatment [4, 5].

After experiencing a stroke, it is essential to utilize a range of rehabilitation methods to tackle the difficulties that may arise effectively [6]. Biofeedback therapy is a non-invasive, drug-free treatment approach that has gained recognition as an effective complementary treatment for individuals dealing with depression [7, 8]. Research studies have shown that biofeedback therapy can help reduce symptoms of depression without producing

any negative side effects, making it a promising option for those seeking alternative or adjunctive treatments for depression [9, 10]. In a research study conducted by Putman et al., it was discovered that the implementation of biofeedback techniques has a favorable impact on alleviating emotional distress in individuals diagnosed with post-stroke depression [11]. Furthermore, a study by Nelson et al. suggested that while biofeedback may have limited psychological effects on stroke survivors, its primary advantage appears to be enhanced physical movement rather than psychological well-being [12].

This study aims to investigate the effects of extended biofeedback usage on depression among individuals undergoing stroke recovery. Since all past studies have only examined the short-term effect of this intervention and no study has considered the long-term effect of this type of treatment on depression in stroke patients, and perhaps interventions that work in the short term but are not particularly useful in the long term, especially in connection with conditions, such as depression, which fluctuates a lot in stroke patients and may even occur several months or even years after the stroke, this research is conducted by the existing knowledge gaps and limited research on the enduring implications of long-term biofeedback on post-stroke depression.

Materials and Methods

This study was a quasi-experimental study with a pre-test-post-test design. This research involves stroke patients referred to a rehabilitation clinic by a neurologist. Patients had to be over 60 years old, have independent mobility in the lower limb, be at the fourth stage of Brunnstrom recovery in the upper limb [13] and have experienced the stroke more than a year before. The exclusion criteria included cognitive or sensory disorders,

upper limb fractures or prior surgeries, and previous participation in a rehabilitation program. In this study, 40 stroke patients were chosen based on specific criteria using a convenience simple sampling method. The patients were split into two groups using double-blind groups to control bias in research studies, a control group consisting of 10 men and 10 women and a group undergoing rehabilitation with long exercise electromyography biofeedback (EMG-BF) with 9 men and 11 women. All patients were initially assessed for depression, and their scores were recorded. A professional and expert occupational therapist performed all the assessments and conducted long-term rehabilitation sessions with and without biofeedback exercises. After two years of treatment and the conclusion of the therapy sessions, the patient's depression levels were evaluated once again. The level of depression in patients was assessed using the long-form geriatric depression scale (GDS) before and after the study [14]. The GDS consists of 30 items that evaluate the emotional and behavioral aspects of depression. The GDS, developed by Yesavage et al. (1986) [15], has been extensively tested and is commonly used with the elderly population. It is a brief questionnaire where participants respond to 30 questions by indicating yes or no based on their feelings on the day of administration. Scores ranging from 0 to 9 are considered normal; 10 to 19 indicate mild depression, and 20 to 30 indicate severe depression.

After a pre-test phase, the control group underwent traditional rehabilitation for two years with 5 sessions per week lasting 60 minutes each. The intervention group had a similar program with the addition of 15 minutes of EMG-BF exercises at the end of each session. The EMG-BF sensors were placed on the skin over the extensor muscles of the wrist and fingers. The patients underwent a training session to get familiar with the biofeedback device and treatment before starting the exercise protocol. During the treatment session, the patient was instructed to contract the wrist and finger extensor muscles and hold the contraction for 5 s, followed by 10 s of muscle relaxation, repeated for 15 minutes in each session [16].

The statistical analysis was conducted using SPSS software, version 22. Descriptive statistics, such as Mean \pm SD, were calculated for two groups. The Shapiro-Wilk test was used to check the normal distribution of the data and to evaluate the impact of long-term biofeedback exercises. It was also used to compare the average level of depression before and after these exercises. Paired t-tests and correlated t-tests were used for inferential statistics with a significance level of $P \leq 0.05$.

Results

Table 1 presents the demographic characteristics of the subjects. The Shapiro-Wilk test results showed that the data distribution is normal. The statistical analysis found no significant difference in the level of depression between the pre-test and post-test stages in both the control and intervention groups (Table 2).

However, a significant difference was observed between the intervention group and the control group after long-term biofeedback (Table 2). On average, patients who used long-term biofeedback showed a decrease in depression after two years compared to the control group. On the other way, after an extended period of biofeedback therapy, a significant disparity was evident between the intervention and control groups (Table 2). The data suggests that, on average, patients who received long-term biofeedback treatment exhibited a reduction in their levels of depression for two years, compared to individuals in the control group.

Discussion

A study was conducted to investigate the impact of long-term biofeedback therapy on depression in individuals who have suffered a stroke. The results indicated that long-term biofeedback therapy had beneficial effects on stroke survivors when compared to a control group. The mental health challenges faced by stroke survivors have always been a primary concern in their treatment and rehabilitation [4]. There is limited existing research on the use

Table 1. Demographic characteristics of the subjects who participated in the study

Groups	Sex		Affected Side		Mean \pm SD			Coma Background After CVA (Month)
	No.		Right	Left	Age (y)	BMI (kg/m ²)	CVA Background (Month)	
	Male	Female						
Control	10	10	9	11	62.1 \pm 13.98	25.02 \pm 4.92	7.7 \pm 3.11	None
EMG-BF	9	11	11	9	58.15 \pm 13.97	25.26 \pm 6.82	7.9 \pm 3.38	None

Abbreviations: CVA: Cerebral vascular accident; BMI: Body mass index; EMG-BF: Long-term biofeedback electromyography group.

Table 2. Statistical analysis of depression in stroke people before and after innervations

Level of Assessment in Groups	Mean±SD	Paired T-test			Level of Assessment in Groups	Independent T-test		
		t	df	Sig.		t	df	Sig.
Pre-control	16.95±3.01	-2.14	19	0.052	Pre-EMG-BF	1.92	38	0.062
Pre-EMG-BF	14.60±3.45				Post-EMG-BF			
Post-control	17.8±3.83	-4.1	19	0.001*	Pre-control	-0.77	38	0.443
Post-EMG-BF	12.5±3.47				Post-control			

EMG-BF: Long-term biofeedback electromyography group.

*P≤0.05.

of biofeedback therapy for depression in stroke patients. However, Chang et al. [17] conducted a study on the effects of biofeedback on depression in stroke survivors, revealing positive outcomes compared to rehabilitation efforts focused solely on physical or occupational therapy. In a pilot study, Li et al. [18] also examined the effects of biofeedback therapy on depressed stroke patients and found positive outcomes concerning their depression and anxiety. Additionally, Keefe et al. [19] investigated the effects of biofeedback on behavioral disorders in stroke survivors and found that it positively influenced depression.

In a comprehensive review conducted by Markiewicz in 2017 [20], it was discovered that biofeedback techniques have demonstrated significant benefits for a wide range of neurological patients, including those affected by stroke, Alzheimer's disease and hyperactivity disorders. Nelson's study [12] specifically delved into the impact of biofeedback rehabilitation on stroke patients, revealing notably positive outcomes in terms of their psychological well-being. These positive outcomes encompass increased self-confidence and reduced symptoms of depression. Additionally, Chang et al. research [17] also highlighted the favorable effects of biofeedback intervention on the overall mental health of individuals who had experienced strokes.

After conducting an in-depth analysis of various images and comparing published articles relevant to our study, we have compelling evidence that long-term biofeedback exercises can effectively contribute to the mental rehabilitation of stroke patients, particularly those struggling with symptoms of depression. However, this research has limitations. These include a relatively small sample size, the absence of gender differentiation in the study and challenges associated with controlling variables due to the extensive duration of the treatment. In light of these limitations, it is strongly recommended

that further comprehensive research be conducted in this field to build upon these findings.

Conclusion

New research has unveiled a groundbreaking discovery in the realm of stroke patient care. The long-term use of biofeedback treatment has demonstrated noteworthy implications for addressing depression in individuals recovering from a stroke. Extensive studies indicate that integrating biofeedback treatment as a complementary approach alongside conventional rehabilitation yields markedly positive outcomes. These results underscore the compelling impact of biofeedback in ameliorating depression specifically within the stroke patient population. The evidence suggests that the efficacy of rehabilitation efforts alone is notably enhanced by the incorporation of biofeedback, heralding a promising advancement in holistic care for stroke patients.

Ethical Considerations

Compliance with ethical guidelines

The study was approved by the Ethics Committee of the [Kharazmi University](#), Tehran, Iran (Code: IR-KHU.KRC.1000.232).

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Authors' contributions

Conceptualization, and supervision: Razieh Yousefian Molla, and Rouzbeh Kazemi; Methodology: Tahereh Haj Ahmad; Writing the original draft: Razieh Yousefian Molla; Investigation, Review and editing: Razieh Yousefian Molla.

Conflict of interest

The authors declared no conflict of interest.

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مقاله پژوهشی



تأثیر درمان طولانی مدت بیوفیدبک بر افسردگی سالمندان مبتلا به سکته مغزی

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چکیده

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مقدمه: افسردگی یک مشکل شایع پس از سکته مغزی است که شیوع بالایی دارد. مطالعات متعدد نشان داده‌اند درمان بیوفیدبک می‌تواند به‌طور مؤثر افسردگی را بدون ایجاد عوارض جانبی درمان کند. هدف از این تحقیق بررسی تأثیر طولانی‌مدت درمان بیوفیدبک بر افسردگی در بیماران مبتلا به سکته بود.

مواد و روش‌ها: مطالعه حاضر از نوع نیمه‌آزمایشی بر روی ۴۰ بیمار سکته مغزی بود که به دو گروه کنترل توانبخشی و گروه توانبخشی‌ای که تحت تمرینات طولانی الکترومیوگرافی بیوفیدبک قرار گرفتند، انجام شد. همه بیماران در شروع مطالعه و مجدداً پس از ۲ سال درمان و پس از اتمام جلسات کاردرمانی با و بدون مداخله بیوفیدبک از نظر سطح افسردگی ارزیابی شدند. تجزیه و تحلیل آماری داده‌ها با استفاده از آزمون‌های تی مستقل و تی زوجی با سطح معنی‌داری (P<۰/۰۵) انجام شد.

یافته‌ها: در دو گروه کنترل و مداخله، تفاوت معنی‌داری در میزان افسردگی در مرحله پیش‌آزمون و پس‌آزمون مشاهده نشد. با این حال، به دنبال استفاده از بیوفیدبک، بین گروه مداخله و کنترل تفاوت اساسی مشاهده شد و میانگین افسردگی در بیمارانی که از بیوفیدبک بلندمدت استفاده می‌کردند پس از ۲ سال نسبت به گروه کنترل کاهش یافت (P<۰/۰۵).

نتیجه‌گیری: استفاده طولانی‌مدت از درمان بیوفیدبک بر سطوح افسردگی بیماران مبتلا به سکته مغزی تأثیر گذار است و این روش درمانی به‌عنوان یک رویکرد مکمل برای توانبخشی معمولی بسیار توصیه می‌شود.

کلیدواژه‌ها:

بیوفیدبک، افسردگی، سکته مغزی، سالمندی

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