



Original Article

The effectiveness of body psychotherapy on executive functions in patients with post-stroke depression

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Abstract

Introduction: Due to the high prevalence of depression after stroke, it is necessary to evaluate and compare appropriate rehabilitations to improve patients in this field. The aim of this study was to evaluate the effect of body psychotherapy on improving executive functions in patients with post-stroke depression.

Materials and Methods: This clinical study performed in Mehrana Nursing Home in Bojnourdi city, Iran in 2019. Twenty women with post-stroke depression were selected by purposeful sampling and were randomly divided into two groups of intervention (n= 10) and control (n= 10). The intervention group participated in body psychotherapy sessions and the control group received routine treatment. Patients were assessed via demographic questionnaires, Beck Depression Inventory, National Institutes of Health Stroke Scale, and computerized tests of executive performance measures including the Wisconsin Card Test, Tower of London, Corsi Blocks Task Test, and Wechsler Numerical Span Test. Data were analyzed by t-test and covariance analysis by SPSS software.

Results: The intervention group showed significant improvements in the Tower of London test ($P= 0.001$), Corsi Blocks Task Test ($P= 0.03$), and Wechsler Numerical Span Test ($P= 0.03$) than the control group.

Conclusion: Based on the findings of this study, body psychotherapy can help improve executive functions in people with post-stroke depression.

Keywords: Body psychotherapy, Depression, Executive function, Stroke

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Introduction

One of the most common disabling disorders of the nervous system is stroke and has the fourth rank in the categories of fatal diseases (1). An average of 750,000 strokes occurs worldwide each year (2). There is a direct relationship between cerebrovascular diseases and their consequent neurological disorders, depending on the location, severity, extent, number, and extent of brain decompositions (3). Post-stroke neuro-cognitive disorders include personality and mood changes, helplessness, emotional variability, and depression. Depression came along with psychomotor retardation and executive dysfunction, showing a clinical profile for people with progressive small vessel disease known as vascular depression. The high prevalence of depression in patients with stroke can intensify cognitive impairment (4). Depressed patients with stroke whose lesion occurred in the left hemisphere have more cognitive impairments than patients with damage to the right hemisphere, indicating that major post-stroke depression is dependent on the lesion in the left hemisphere (5).

One of the important predictors of depression and intensifying post-depression disabilities in these patients are impaired memory and impaired executive function (6). Executive functions are processes such as concentration, attention, planning, control of thoughts and behavior, organization of reasoning, and memory that originate within the brain to have intellectual and purposeful activities (7). The ability to control and coordinate behavior, monitor one's behavior, inhibit inappropriate responses, goal planning, future-oriented behaviors, and flexibility are tasks of executive functions done via active memory, response inhibition, flexibility, planning, reasoning, and attention (8). In addition, executive functions have warm and cold functions that are carried by the pre-frontal cortex that is related to abstract thinking (cold) and lateral parts that regulate emotions and motivations (warm) (9).

Damages of executive functions usually are recognized as functional impairments of the frontal, but these functions are impaired in patients with stroke without damaged forehead

(10). Executive dysfunctions have two symptoms: hypoactivity, such as lack of motivation and emotional slowness, and the second symptom is hyperactivity, such as distraction, deterrence, impulsivity, and irritability. Middle cerebral artery injury, striatum, anterior artery injury, and its arterial aneurysm are also subarachnoid hemorrhages that can impair executive function in stroke patients (11). Almost one out of every four-stroke cases is fatal, and survivors also suffer from long-term problems from brain damage. Some patients regain their former independence after a long time, though unfortunately, many never fully recover. About half of all stroke victims depend on others for daily activities and self-care. The rehabilitation program does not necessarily amend the damage caused by a brain attack. Instead, rehabilitation is performed to restore the patient's strength, capacity, and self-esteem so that daily activities can continue despite the effects and complications of stroke (12). Most studies of post-stroke depression have focused on the efficacy of medical therapy. However, even concerning the efficacy of pharmacological treatment, the results regarding post-stroke depression are limited. As the results of a recent review show, out of 32 studies, only two studies have addressed the non-pharmacological treatment of depression in post-stroke patients. Less than 10% of patients have shown remission, indicating the necessity and importance of devising and implementing effective treatment modalities (13). Shapiro et al. emphasized that pharmacological therapies do not only have an impact on post-stroke depression but can also cause severe bleeding and heart problems in these patients. Therefore, appropriate non-pharmacological therapies should be designed for these patients (14).

Studies show that symptoms of depression in post-stroke patients are neglected, but appropriate interventions are not designed for this problem. While a high percentage of patients suffer from cognitive impairment due to stroke and the need for effective rehabilitation has always been emphasized (15). In Iran, there have been few studies about cognitive-based rehabilitation focusing on decreasing depression

(16,17). While cognitive impairments of stroke are in the center of attention, physical side effects are also significant. So using a combination of physical and psychological therapies is recommended. In the body, psychotherapy motions are special bonds between the mind and body. In its view, chronic repression of emotions and obstruction of life energy can lead to stress, neurosis, and possibly psychosis. Releasing this suppressed energy and blocked emotions through physical activity can help reduce stress and maintain the organism's overall health (18).

In body psychotherapy, it is believed that the health of individuals is a reflection of their body's health and mental health. Balancing the body, mind, emotions, and psyche is not just about eliminating morbid traits. Psychological and emotional problems and imbalances are only part of one's overall problems and psychological imbalances (19). Body psychotherapy is an active and dynamic approach. It is used because of its power to create movements in the psyche and to utilize physical and emotional systems and emotional release from diseases such as depression, hopelessness, anger, and anxiety associated with emotional suppression. It results in rapid improvement and positive therapeutic response (20). This technique facilitates the emotional release and is used in conjunction with breathing exercises. Breathing, as the most vital function of the body at any given moment, occurs regularly, and this inward observation not only regulates his/her thinking and focuses but also deepens breathing, reduces stress, and avoids rumination and mental distress (21).

The main goal of movement therapy is to integrate mind and body and to note that changes in motor behavior are the reflection and consequence of changes in the psyche (22). Studies on the efficacy of physical psychotherapy in all areas of health are minimal, and no study has been conducted on post-stroke depression. Several studies have evaluated the efficacy of movement therapy subsets such as movement and exercise on the executive function of older people (23,24). Treatments such as physical therapy are likely to involve the mind and body in the therapeutic process,

resulting in changes in brain function and enhancement in abilities such as planning, flexibility, and delicate movements. Before and after the intervention program, brain maps of patients with brain injury found that the intervention group produced more neural networks in different brain regions (25).

A review of related studies in Iran indicated that few studies have dealt with post-stroke depression, emphasizing cognitive techniques. No study has examined the effect of movement therapy or other similar body psychotherapies to treat post-stroke depression. Furthermore, few studies have used body psychotherapy to treat depression (26). Therefore, it is unclear what effect the treatment will have on post-stroke depression, given its high prevalence and the critical importance of treating depression to increase the chance of patient survival (27). Therefore, it is essential to evaluate therapeutic protocols related to this kind of depression. This study aimed to evaluate the effectiveness of body psychotherapy intervention on the executive functions of patients with post-stroke depression.

Materials and Methods

This clinical trial registered with IRCT code: IRCT20190812044518N1. This study was carried out on patients admitted to welfare centers of Mehrana Elderly Care Center in Bojnourd city-Iran after approving the project at Faculty of Psychology and Educational Sciences of Ferdowsi University of Mashhad and Ethics Committee of North Khorasan University of Medical Sciences. The sample size estimated based on the previous studies ($n=20$) which were assigned randomly to control ($n=10$) and intervention ($n=10$) groups. The participants were selected through purposeful sampling method. The inclusion criteria: aged 25-65 years, having literacy, history of stroke based on medical records and physician approval, duration of six months to one year from past stroke patients, left hemisphere lesion based on medical record including patient imaging and clinical examination, location of the lesion based on medical and imaging record, score of National Health Center Stroke Assessment Tool >20 , and Beck Depression Test <10 . The

exclusion criteria included: having second stroke, aphasia, consciousness disorder, using tobacco, report of recent stressful experience, and psychological disease except depression.

Research instrument

A) *Medical and Demographic Questionnaire*: It includes the variables such as age, education, and marital status. Medical information was extracted from patient records.

B) *Beck Depression Inventory*: This inventory has 21 self-report items with four-choice that assess the symptoms of depression. The scores less than 10 indicate a minimum degree of depression in subjects, scores between 10 to 18 point to mild to moderate depression, and scores 19 to 29 show moderate to severe degrees of depression, and the scores 30 to 63 indicate severe depression (28). Khaledian et al. have reported the reliability and validity of the instrument as 0.73 to 0.93 (27).

C) *Wisconsin Card Test*: This test has 64 cards, including four symbols of the triangle, plus circles and squares in four colors of blue, yellow, red, and green. The subject should replace them according to the rules in the card classification (29).

D) *The Wechsler Numerical Span Test*: It consists of direct and reverse digits methods. First, sequences of numbers are presented audio-visually to the subject. Then, the subjects must

repeat the digits in the same order as they were requested in the direct and reverse sections. After each step, one digit will be added, and the test sequence will be discontinued (30).

E) *The Corsi Blocks Task Test*: It can be used to measure spatial-visual and short-term memory components in the preschool ages group up to 80 years of age. The test consists of 9 irregular cubes, which are then asked to repeat the question after the presentation (31).

F) *Tower of London Computerized Cognitive Tests*: The Tower of London test also includes colored beads on three bars. Each item is asked to trim the beads like the target image shown at the top of the page. Assignments begin with the least number of movements that the subject must solve, such as two, three, four, five movements, and are considered performance criteria, total test time, some errors, and total score. The Tower of London test is used to measure planning ability (32).

Procedure

The body psychotherapy included 35 sixty-minute sessions, three times a week, based on the Röhrich et al. study (33). The researcher conducted the intervention after confirming ability by the professors and experience of treatment activities for the elderly with occupational therapy degrees in welfare centers.

Table 1. Summary of the interventional sessions

Sessions	Summery
1-6	<ul style="list-style-type: none"> - Establishing a good relationship between the consultant and the group members, between the group members, familiarizing them with the rules of the group, explaining the rules and the framework of the group plan by the leader - Introducing members to the concept of body psychotherapy, describing physical psychotherapy, identifying depressants and its physiological symptoms in the body, explaining the effect of physical therapies on depression, soft walking, static stretching movements with movement restrictions, the synchronized movements between the eyes and hands - Providing increased information and awareness through physical exercises, giving tasks to members (daily physical experience record in conditions of depression and discomfort) - Walking soft - Static limb movements - Harmonious movements of the eyes and hands - Performing short rhythmic movements proportional to age and limitation -Dynamic tensile movements and increased range of joints - Explain the importance of breathing and proper breathing training - Exercise breathing and relaxation with stressful parts of the body -Preparation of eye movements desensitization refinement - Increase motivation to work through the use of motivational interviewing techniques and provide motivational therapy logic - Providing information on the role of defenses, avoidances, blockages and traumas on depression

	- Identification of obstructions, avoidances, defenses and traumas by members
7-12	- Static and dynamic stretching - Equilibrium motions - Rhythmic movements with coordinated hand movements - Explanation training of eye movements desensitization with breathing exercises - Explain the boundary between yourself and the other - Walking soft - The coordinated movements of the hands and feet - Perform rhythmic movements - Exchange of information about the unity of mind and body - Exercise, exercise, exercise and relaxation
13-18	- Awareness of body senses - Practice horizontal eye movements with breathing exercises - Static and dynamic stretching - Provide relaxation and breathing techniques - Preparation of eye movements desensitization refinement - Perform coordinated eye and hand movements - Upper limb stretching - Perform rhythmic movements
19-24	- Exercise static stretching exercises - Perform dynamic stretching exercises - Walking soft - Perform rhythmic movements and sequences - Performing balance exercises - Practice horizontal eye movements - Rhythmic motions and sequences - Performing balance exercises - Perform breathing and relaxation exercises - Preparation of eye movements desensitization refinement
25-30	- Walking soft - Exercise breathing and meditation exercises - Static stretching exercise - Perform coordinated eye and hand movements - Perform rhythmic and sequential movements - Perform dynamic stretching - Preparation of eye movements desensitization refinement - Group walking with rhythmic movements - Perform balance exercises
31-35	- Perform breathing exercises - Walking soft - Static and dynamic stretching exercises - Consecutive and rhythmic movements - Preparation of eye movements desensitization refinement - Evaluate thoughts and perform breathing and relaxation exercises - Upper and lower extremity tensile movements - Rhythmic and sequential motions - Content review, feedback, questions and answers - summary, post-execution

Data analysis was performed using SPSS version 20, descriptive statistical tests (frequency, percentage, mean, standard deviation) and inferential methods (Chi-square, t-test for independent groups).

Results

Demographic results showed that the youngest participant was 41 years old and the oldest aged

59 years. The mean age was 50.66 ± 4.66 years. Table 2 compares the level of education, marital status, and age of participants by the group. The descriptive indices of Table 2 show that the two groups were not significantly different in terms of education, marital status, and age ($P > 0.05$).

Table 2. Descriptive indicators of participants' demographic status

Variables		Control	Experimental	X ²
		Frequency (Percent)	Frequency (Percent)	
Marital status	Married	6 (60)	6 (60)	X ² = 0.37
	Single (single, divorced, widow)	4 (40)	4 (40)	P= 0.77
Education	Academic	4 (40)	5 (50)	X ² = 0.9 P= 0.92
	Diploma	5 (50)	4 (40)	
	Elementary	1 (10)	1 (10)	
Age (Year)	41-49	5 (50)	4 (40)	X ² = 0.83
	50-59	5 (50)	6 (60)	P= 0.65

Executive functions, including Wisconsin test results, London Tower test, Corsi test, and memory test, were assessed at pre-test and post-test stages (Table 3). The results showed that there was no significant difference between the

control and intervention groups in pre-test stage. However, there was a significant difference between the two groups in all variables after the intervention ($P < 0.05$).

Table 3. Comparison of pre-test and post-test in executive functions of the control group and physical psychotherapy group

Tests	Stages	Mean standard error	Mean differences	T	df	P
Wisconsin	Pre-test	0.055	-0.046	-0.83	18	0.41
	Post-test	0.063	-0.041	-0.64	18	0.52
Tower of London	Pre-test	1.19	0.2	0.16	18	0.86
	Post-test	2.37	0.96	4.55	18	*0.001
Corsi Blocks Task Test	Pre-test	2.36	2.4	1.01	18	0.32
	Post-test	1.99	4.6	2.3	18	*0.03
Wechsler Numerical Span Test	Pre-test	1.22	-0.5	-0.4	18	0.68
	Post-test	1.05	2.4	2.28	18	*0.03

$P < 0.05$

Discussion

The purpose of this study was to evaluate the effectiveness of body psychotherapy on the executive function of patients with post-stroke depression. The results showed that the experimental group showed a significant improvement after the intervention compared to the control group. Consistent with the findings of the present study, the results of studies by Röhrich et al. (34), Cusin and Dougherty (35), Khanjani et al. (36), changes in salivary cortisol

levels and behavioral anxiety were significantly different (12). It has also been reported that bodily-based treatments are effective in reducing persistent depression. Depression is strongly correlated with executive function, and depression scores are associated with increased improvement in executive functions (37,38). The study results by Herbert and Sparham also showed that psychosomatic treatments have a positive effect on executive function (39).

In explaining the mechanism of this method, Milot and Plamondon concluded that exercises such as body psychotherapy can contribute to repairing these cognitive deficits by creating new neural networks (40). The nature of the used techniques is that the therapist actively encourages the patient to discover and express their thoughts and feelings about their other relationships, including their styles and behaviors. This process led to the discovery of repetitive interpersonal patterns that effectively reduce rumination and depression from interpersonal problems. Also, group therapy releases endorphin encephalin hormones, which are remarkably elevated in the plasma of the androgenic opioid peptides (endorphins and enkephalins), increasing energy and the patient making more moves. Exercising causes neuron generation in different parts of the brain. Some studies have shown that plasma levels of endorphins increase with movement and cardiovascular training exacerbates this effect (41). Studies have shown that movement therapy leads to neurodevelopment, enhances brain function and improve mental health (42). Techniques used in psychotherapy sessions, including breathing, relaxation of body-thoughts communication, extraversion of thoughts, eye movements, increased overall efficacy, exhaustion of suppressed physical emotions, and reduced fear of movement. Group exercise releases endorphin-releasing encephalin hormones, which reduce depression in individuals (43). The movement also affects altering blood flow, reducing the risk of neurodegenerative and age-related cognitive deficits, and improving learning and memory function (37). Unlike what was once thought to be produced in life, brain cells can also produce better synapses by moving. Synapses are the link between neurons that help store information. Exercise therapy generates new brain cells in the hippocampal area of the brain, which is the key to learning and memory. Recently, much research has been conducted on the effect of exercise on brain function, and several biological mechanisms have been proposed for the effects of physical activity on brain function (44). Improving brain and nerve function

through appropriate activities such as gestures and, in particular, rhythmic motions can speed up the process of neuro generation (15).

Since the present study was one of the few studies that utilized body psychotherapy to treat depression, it has limitations such as fatigue, wornness, fear, and lack of motivation in patients, which limited the number of cases (ten cases in each group), lack of previous studies to compare achievements and differences and similarities of results of the present study, low computer literacy in patients to understanding and completing tests which limited participants to educated individuals, and it is unclear how these results might be achieved in those with lower education. Also, the researchers did not follow-up the results permanently for the research team. Therefore, it is recommended to prioritize the therapeutic process of patients after stroke and to use non-judgmental therapies such as movement therapy as a valuable, practical, safe and economic approach. It is also suggested that future studies of these studies be performed in larger groups with different age groups, and different demographic characteristics and compare them according to age (sex, education, and marital status). The integrating physical psychotherapy and comparing it with other interventional methods in people with post-stroke depression is recommended.

Conclusion

The results of this study indicated that body psychotherapy was effective to improve the executive functions of post-stroke patients including programming ability, cognitive flexibility, spatial-visual memory components, short-term memory, abstract reasoning, and abstract reasoning while facing environmental challenges. Based on this, it can be said that therapies such as body psychotherapy that simultaneously focuses on movements, mind and a combination of motor and mental therapies can help improve the status of patients with post-stroke depression as a treatment by medical teams to prevent post-stroke disability.

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