

Acceptance and Commitment Therapy for Reducing Interference and Improving Verbal and Visual Working Memory in Patients with Multiple Sclerosis

Leila Shameli¹ (PhD), Maryam Davodi¹ (MSc)

1. Salman Farsi University of Kazerun, Kazerun, Iran

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Corresponding Author:

Leila Shameli,
Salman Farsi University of Kazerun,
Kazerun,
Iran
E-mail: dr.shameli@kazerunfu.ac.ir

Abstract

Introduction: Multiple Sclerosis (MS) is a disease possibly leading to increased interference and difficulty in verbal and visual working memory. The present research attempted to investigate whether Acceptance and Commitment Therapy (ACT) would affect interference as well as the verbal and visual working memory of MS patients.

Method: This study was a quasi-experimental research with a pretest-posttest and a control group. The statistical population included all the MS patients referring to Ahvaz MS Society in 2019. A total of 30 patients were selected through purposive sampling and were randomly divided into experimental and control groups (each containing 15 individuals). The subjects were then examined using the Stroop Test and Wechsler Memory Scale-III. The data were analyzed using multivariate analysis of covariance.

Results: The results showed a significant difference between the two groups in terms of interference ($F= 7.48, P\leq 0.01$), verbal working memory ($F= 24.69, P\leq 0.001$), and visual working memory ($F= 22.82, P\leq 0.001$).

Conclusion: This study highlighted how effective ACT was on interference and working memory of MS patients. Thus, clinical MS specialists can use this treatment for their patients to optimize care.

Keywords: Acceptance and Commitment Therapy, Multiple Sclerosis, Verbal Working Memory, Visual Working Memory

Introduction

Multiple Sclerosis (MS) is characterized by the occurrence of widespread lesions or plaques in the brain and the spinal cord [1]. Due to the lesions and their unpredictable locations, MS patients may suffer from neuropsychological abnormalities including impaired cognitive performances such as dysfunction of working memory, attention, information processing, executive performance, concentration, and learning [2, 3]. Research on working memory deficits in MS patients has shown that MS multi-factorial demyelination leads to disorders in several brain-bound regions, causing working memory disruption [4]. According to traditional approaches, working memory includes the components of cognitive function that allow a person to immediately understand and provide mental responses to the environment, maintain information for a short time, support knowledge acquisition, solve problems, and act according to goals [5]. Working memory resources include verbal and visual working memory. Visual memory plays a key role in the formation and manipulation of mental images. On the other hand, verbal memory covers the phonological loop. The verbal information provided verbally enters the phonological loop directly, immediately and automatically, and is stored phonologically for a short time [6]. The feature of the working memory is its limited capacity; therefore, various factors are responsible for this limitation, some of which are as follows: limitation of the activation

extent in the working memory system, interference [7], information processing speed, and lack of ability or knowledge for encoding [8].

A common explanation for interference is the relative processing speed, which is most simply argued as the fact that faster processes can affect slower ones, but the opposite is not true [9].

Since disturbances in interference and working memory are symptoms of MS and cause the disease to be considered severe and incurable, and may also cause psychological problems, researchers are trying to evaluate the effect of various psychotherapies on improving these symptoms and ultimately the process of the disease.

On the other hand, as anxiety in MS patients is an integral part of their illness, negative association between MS-induced anxiety [10] and cognition is most evident when attention resources are directed towards external or internal threatening stimuli. So, attention needs to be paid to threatening stimuli to be bold, since it acts as interference and reduces the working memory and daily activities [11].

Given that no study has been conducted on this issue, carrying out related research is suggested. It has been shown that behavioral therapies might affect the beliefs and factors involved in MS and can play an important role in improving working memory and interference [2, 11, 12, 13].

One of the third wave therapies that have received more clinical attention within the last few years is Acceptance and Commitment Therapy (ACT). This treatment is essentially process-oriented and clearly emphasizes the promotion of accepting psychological experiences and commitment by enhancing flexible and adaptive meaningful activities, regardless of the content of psychological experiences. The emphasis of ACT on acceptance and values and living on accepted values has made it a treatment ideally suited to MS patients [14]. The anxiety which MS induces on the patients [15] will lead to increased interference and difficulty in problem solving, attention, information processing and, as a result, reduced working memory [4], and this will ultimately lead to challenges for the patients. MS is considered to be unpredictable and is also one of the diseases that changes patients' lives, because it disturbs the best part of their lives and gradually leads them to disability. Given the wide prevalence of MS in recent years and the lack of information on the incidence and process of the disease and its impact on different aspects of life on one hand, and the patients' mere resort to medical treatments due to insufficient access to psychological therapies on the other hand, evaluation of cognitive aspects and application of the methods to reduce interference and improve verbal and visual working memory of the patients and assessing the effect of such therapies on improvement of MS patients is of great importance. Since there was not much information available and the patients merely resorted to medical treatments due to insufficient access to psychological therapies, this study aimed at finding out whether ACT affected the interference and verbal and visual working memory of the patients with

multiple sclerosis or not.

Method

This randomized, single-blind clinical trial was conducted in Golestan Hospital in Ahvaz, Iran, once having been approved by the ethical committee of the Islamic Azad University of Kazerun. Regarding its objective, the present study is an applied research, and concerning the data collection method, it is a quasi-experimental study which has been carried out in the form of a pre-test/post-test with a control group. A total of 30 eligible MS patients from Ahvaz MS Society were selected through purposive sampling in 2019. The statistical population included all the MS patients referring to Ahvaz MS Society in 2019. Based on the minimum sample size in the experimental studies, the size of the groups was determined to be 15 [16]. Therefore, 30 patients whose disease was classified as mild by the doctors using the Expanded Disability Status Scale (EDSS) were selected through purposive sampling and were randomly divided into the experimental and control groups, each containing 15 individuals. The participants were selected with regard to the inclusion criteria (having a history of the disease for over three years and being diagnosed with mild MS) as well as the exclusion ones (being diagnosed with severe MS and not having addiction, cancer, epilepsy, renal failure, heart disease, and major psychological problems such as psychosis) which were assessed through a clinical interview.

The used tools in this study were as follows:

Expanded Disability Status Scale (EDSS): This scale along with the patients' medical records and doctors' diagnoses were used to measure the MS patients' severity of disability. The EDSS was developed by Kurtzke in 1983 [17]. Each individual's score ranged from zero (natural neurological examination) to 10 (death from MS), and according to John's classification criteria, the patients were classified into three groups with mild (0-3), moderate (4-6), and severe (7 and more) disease [18]. The psychometric evaluation of the scale was satisfactory in the study by Nortvedt [19] and its predictability was appropriate, so that a high reliability was reported for this scale. The validity and reliability of this scale was also reported to be good in an Iranian research [20]. The reliability and validity of the scale were 0.67- 0.92 and 0.42- 0.66, respectively, in a research by Sharrack et al [21]. The Cronbach's alpha in this research was 0.60.

Computerized Stroop Test (CST): This test which was developed by Capovilla [22] evaluates the capacity to attend to specific characteristics of a stimulus, ignoring the characteristics irrelevant to the task. To do this test, 48 matching and 48 mismatching-colored words (red, blue, yellow and green) were shown to the subjects. The subjects were asked to say each word's color, regardless of its meaning. According to the researchers, the mismatching color-word task (second phase of the experiment) measured interference. The degree of interference was obtained by subtracting the number of correct mismatching words from that of correct matching ones. The research carried out on this test showed its good validity and reliability in measuring inhibition in

adults. The reliability of the test ranged from 0.80 to 0.91, as reported in a retest [23]. To evaluate the validity of the tool, the validity test method along with the reaction time measuring device YAGAMI YB-1000 was used, and the correlation between the reaction times of the two devices was 0.85 [24]. The reliability and validity of the test in this research were 0.91 and 0.80, respectively [25].

Wechsler Memory Scale - Third Edition (WMS-III): This scale was developed by Wechsler in 1945 [26] and was rebuilt by the Psychological Institute in 1987. The test has 18 subscales (11 primaries and 7 optional subscales), but in this research, only two subscales were used to measure the verbal and visual working memory. Visual Memory Subscale is a visual rehabilitation test, in which the subject is asked to use his/her memory to draw the simple shapes provided to him/her for 10 seconds. The total scores of forward and reverse digit span subtest were also used to measure the verbal working memory. The reliability

coefficients for the visual memory and verbal memory were 0.82 [27] and 0.83 [28], respectively. The reliability of this test in Iran was 0.78 [29]. The validity of the scale scores using retest validity fluctuations was assessed and ranged from 0.28 to 0.98, and 0.72 and 0.68 for verbal and visual memory, respectively [30]. The reliability of the test in this research was 0.80.

The experimental group attended 120-minute sessions once a week held by the MS Society of Ahvaz based on the model adapted from ACT's six-session protocol for chronic illnesses in the aforementioned Society [31] (Table 1). The control group received no therapeutic intervention. The ACT's therapy was performed by the second author, a therapist with a degree in ACT. Following the completion of the sessions, both groups were given a post-test. All the analyses were conducted using SPSS-22 and MANCOVA to examine the statistical significance of our findings.

Table 1. Summary of Sessions Based on the Acceptance and Commitment Treatment

Topic	
Session 1	Introductions, the facilitators and the treatment rationale, performing pre-tests
Sessions 2	To learn about thoughts, emotions, behavior and physiology, to understand how strategies like suppression can be unhelpful, to learn about mindfulness as an awareness technique
Sessions 3	To understand what values are and how to identify them
Sessions 4	To identify values-based goals
	To learn about diffusion from thoughts To learn about problem solving strategies
Sessions 5	To learn about how communicating assertively in living can be helpful in doing more valued activities
	To identify stepping stones in line with your values
	To practice mindful acceptance
Sessions 6	Reviewing the values of relationship and committed action, the experience of individuals within themselves as the context

Results

The demographic characteristics as well as the mean and standard deviation of the dependent variables in both groups can be seen in Tables 2 and 3.

The independent samples, t-test and chi-squared test showed no significant difference between the two groups in terms of all demographic variables ($P > 0.05$).

Prior to multivariate analysis of covariance, its presuppositions were first examined. The results showed that the presuppositions of variance equality obtained

through Levene's test were $F=0.55$, $p= 0.36$ for interference, $F=3.89$, $p= 0.06$ for verbal working memory, and $F=0.10$, $p= 0.75$ for visual working memory. The BOX's test showed the equality of the covariance matrices as well ($P= 0.47$, $F= 0.94$, BOX's $M= 6.37$). Another important presupposition of covariance analysis was the equality of the regression coefficients in both groups, which was not significant at the factor level ($F= 1.58$, $P= 0.22$). Accordingly, the use of MANCOVA was allowed in this research.

Table 2. Comparison of Demographic Characteristics

Variable		Experimental	Control	
		n=15	n=15	
		N(%)	N(%)	
Undergraduates		5 (33.3)	3 (20)	* P= 0.81
Education Diploma		3 (20)	5 (33.3)	
Bachelor's degree		6 (40)	5 (33.3)	
Master's degree		1 (6.7)	2 (13.3)	
Gender	Women	10 (66.6)	10 (66.6)	*P= 0.07
	Men	5 (33.4)	5 (33.4)	
Age		35.30 (8.18)	34.6 (7.80)	*P= 0.13
Marriage	Single	1 (6.7)	3 (20)	*P= 0.28
	Married	14 (93.3)	12 (80)	

The results of the MANCOVA obtained for Wilks' lambda were statistically significant at 95% confidence level ($F=$

12.83, $P \leq 0.001$). Thus, the two groups had a significant difference in terms of at least one dependent variable. To

investigate this difference, the results of multivariate analysis of covariance were performed in a one-way analysis context (Table 4).

Table 4 shows that the differences between the two groups were significant in terms of the interference level ($F= 7.48, P \leq 0.01$), verbal working memory ($F= 24.69, P \leq$

0.001) and visual working memory ($F= 22.82, P \leq 0.001$). Also, considering the variable changes in the post-test in both groups (according to Table 1), it can be concluded that treatment led to decreased interference and improved verbal and visual working memory in the MS patients.

Table 3. Mean and Standard Deviation of Pre-test and Post-test Scores in Both Groups

Variables	Groups	Control Group	Experimental Group
		M ± SD	M ± SD
Interference	Pre-test	0.83± 0.57	0.78± 0.46
	Post-test	0.81± 0.54	0.51± 0.32
Verbal working memory	Pre-test	6.26± 3.34	7.40± 3.87
	Post-test	5.67± 3.11	9.53± 2.92
Vision working memory	Pre-test	9.27± 2.55	8.13± 3.48
	Post-test	8.53± 2.88	10.60± 2.02

Table 4. Results of Multivariate Covariance Analysis on the Mean of Post-test Scores with Control of Pre-test

Dependent Variables	Sum of Squares	df	Mean Square	F	P	Partial Eta Squared	Observed Power
Interference	0.69	1	0.69	7.47	0.01	0.23	0.75
Verbal working memory	57.30	1	57.30	24.70	0.001	0.50	0.99
Vision working memory	48.52	1	48.52	22.82	0.001	0.48	0.99

Discussion

According to the results of this study, ACT reduced interference and improved the verbal and visual working memory of the patients with MS. The third wave therapies, interference and declined verbal and visual working memory in MS patients are rooted from the thoughts caused by their incurable and catastrophic disease [32, 33, 13]. Having a special emphasis on the six dimensions of flexibility, especially cognitive fusion, acceptance, and being present, ACT helps individuals to accept their illness and free themselves from past and future thoughts that carry rumors and worries.

The results indicated that third wave therapies [11, 12] could be a simple tool for providing recommendations for improving cognitive abilities such as information management strategies [34], increasing attention and, as a result, reducing interference [12]. Interference is an automatic process that cannot be easily controlled, but ACT can somewhat control it by using techniques such as being at the present time and the cognitive fusion existing in this treatment [8]. It helps the patients to experience their inner experiences as a thought, and using mindfulness, acceptance, and cognitive fusion to increase their mental flexibility rather than responding to their thoughts, focus on life values and the things that are important for them [35]. Providing acceptance to the individuals, ACT can eliminate their mental challenges to respond to the thoughts associated with their disease, which are the faster processes of the MS patients' minds. Consequently, instead of constantly looking for the causes of their problems, they will accept the questions and emotions without trying to eliminate, modify and suppress them and achieve the peace they have not already had [11], which may ultimately lead them to cognitive flexibility [36]. This might result in reduced interference by helping to spend more time on other activities.

ACT also aims at helping MS patients to accept psychological pain and keep their lives in line with their personal values, despite the presence of reversible symptoms [32]. It allows the patients to take into account their values and distinguish between their real values and the thoughts arisen from their minds filled with the condition, disease, and worries, and thereby increase their focus on the activities they are currently doing. This will lead to reduced interference and faster work. With its central processes, ACT teaches the patients how to abandon the idea of thought inhibition, get rid of disturbing thoughts, and strengthen self-observation rather than self-concept [37]. Instead of focusing on elimination of harmful factors, the acceptance and commitment approach helps the clients to get rid of controlling the verbal rules that cause them problems, and allows them to stop fighting and confronting such problems [38].

The ACT improved the verbal and visual working memory of the patients with MS, and this was another result. According to the research, an important factor that affects memory is processing speed [3]. Factors such as emotional experiences, previous information and concurrent information entry may slow down the processing speed and, unfortunately, this occurs in patients with MS due to the volume of information and their synchronization [39]. This slow information processing will inevitably affect the memory function. So, ACT uses the tools such as bus metaphors and toolboxes to help such people regulate and simply observe their thoughts. There are techniques that people can learn to break and let go of this defective cycle, instead of fighting and suppressing their thoughts and getting caught up in the defective cycle of thoughts and emotions, and getting rid of this cycle leads to regulating their thoughts, as well as highlighting and getting the information they need at the moment [32].

In other words, impairment of cognitive functions covers many aspects of everyday life including the ability to manage family [40]. This is especially problematic in young patients who need to learn and remember large volumes of information. The cognitive deficits even disrupt the person's social and family relations, leading to reduced confidence and increased feelings of anger in patients [2]. So ACT can organize thoughts through the techniques it provides. Such training can be effective in some executive activation such as attention. Considering the fact that the working memory is one of the dimensions of cognitive performance in the attention mechanism [35], it is possible to properly use cognitive therapies such as ACT as a cognitive-based regular treatment to compensate cognitive deficits. Also teaching cognitive techniques, including information processing, might have a positive effect on improving the performance of verbal working memory in the children with learning disorders, as the difference between the scores of the digit span pre-test and post-test was statistically significant ($P < 0.05$) [41, 42]. In addition, studies [43, 44] showed that cognitive training, focusing on cognitive abilities, could influence the individuals' thinking skill and lead to improved performance of visual working memory.

One limitation of this study was that the sessions were held in summer, and the bad weather conditions in Ahvaz caused the patients to get tired soon. As a result, interference increased and the techniques of keeping things in the working memory decreased [45]. Other limitations included the lack of access to the patients with different severities of the disease and the lack of a follow-up period of a few months after the post-test to determine the effectiveness of the therapy more accurately. The lack of control over the patients' anxiety and depression and the unequal number of men and women were considered as the other limitations which might have affected the results of this study. In this regard, researchers are suggested to consider these limitations, and therapy should be performed on other physical and psychological disorders and other clinical populations, as well as other psychological problems of the individuals with chronic disorders. Also, long-term follow-up tests should be performed in order to determine the extent of the effects of therapy. Using this kind of psychotherapy for MS patients is recommended.

Conclusion

In general, the results of this study indicated that ACT could reduce interference and improve working memory (verbal and visual). Therefore, ACT therapy can help organize and improve people's thoughts and emotions, and getting rid of the cycle can also be improved in order to minimize interference and improve memory.

Conflict of Interest

The authors declare that they have no conflicts of interest and no financial benefits from this study.

Ethical Approval

This study was approved by the Islamic Azad University of

Kazerun with the code IR.IAU.KAU.REC.1398.165. An informed written consent was obtained from all the patients participating in this study.

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