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The effectiveness of cognitive rehabilitation on the memory recovery in people with mild cognitive impairment

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ABSTRACT

The main aim of the study is to determine the effectiveness of cognitive rehabilitation on the working memory recovery in people with mild cognitive impairment. The design of the study is a semi-experimental type with pre-test and post-test design of control and experimental groups. The statistical community of the study is subjected to people with mild cognitive impairment which has been evaluated with early physician diagnosis and psychologist assessment with MMSE test and Vexler memory. At first, the subjects were evaluated with computer software N-Back1 and N-back2 to evaluate their working memory. Based on this process people with this disorder were sifted and divided randomly in two groups of experimental and control (each group includes 15 ones). Then, the experimental group received 12 sessions' interventions, two hours in 12 weeks. To study these interventions, the whole subjects were retested with N-Back1 and N-Back2 programs after ending 12 sessions. In order to analysis the data, MANCOVA covariance analysis statistical test was applied; the results representing the increased mean of experimental working memory scores in compare to control group; hence, it can be concluded that the rehabilitation of cognitive issues can lead to the recovery of working memory function. ($F=12.12$; $\text{sig}>0.01$). ($F=11.91$; $\text{sig}>0.01$). The cognitive rehabilitation has an impact on the recovery of people with mild cognitive impairment.

Key words: mild cognitive impairment, cognitive rehabilitation, working memory

INTRODUCTION

The mild cognitive impairment is also called the early demand or the broken down of memory impairment and when these become severe in terms of education and people age, there can be a significant intervention made in relation to daily life and the related activities. In fact, this disorder is a temporary period between cognitive deficiencies in old-aged people and problems from Alzheimer. This kind of disorder affects on the language, attention, deduction, judgment, reading and writing; anyway, the mild cognitive impairment is the most common disorder in the problems of the memory [11]. The prevalence of the disorder is along with increasing people age; its prevalence is usually between 70-79 year old 10% and 80-89 year old about 25%. One group prone to the risk is those ones who experienced the disorder before. This illness stands between healthy old age and early symptoms of the brain collapse; people with this kind of disorder say that they have got mind and memory problems and never act in memory tests; however, they act in a normal way; about a half of people with this disorder have a mild cognitive

impediment would have diagnosed with Alzheimer disease 3-5 year after the disorder [1]. The cognitive collapse determined in patients with Alzheimer is obvious before the beginning of the disease. The studies that studied pre-clinical period have determined the early emergence of the disease in connotative memory; (for example, a mood of cognitive impairment as mild range). The disorder of connotative memory can take place through a Seri of processes deficiencies such as motivated learning, recalling aspect of prescription memory, recalling memory for evaluating two various events. According to the early observations, it is indicated that before starting the Alzheimer the cognitive changes such as semantic knowledge collapse in calling the related demands and tasks are clearly apparent. And the deficiency of executive performance at assignments requiring to manipulation of mind information are also clear with special symbols such as working memory. The pattern and progression of cognitive nerve is suitably granted with the distribution and expand of Alzheimer pathological issues and they are considered as the cognitive indicators of early illness appearance [15]. The short memory is recognized as the transient part of recording data in the brain sending the data to long memory; the studies of short memory in 1970s was carried out by two researcher leading to the development of short memory concept [8]. The working memory is a part of high level cognition reactions and called for the manipulating active highly information in the brain. This system is responsible for saving temporary information to cognitive system; in addition, along with this kind of system, it manipulates the data easily. The human model of working memory is including two main parts; one is the system of controlling executive actions by the name of central executive system and considered as a decision making system processing the whole material and data planning to process the information as well; the central executive system is being supported by two sub memory parts naming sound-based axis and sheet-based space and visual which the second working memory can be consisted having responsibility of saving and processing the verbal and non-verbal short term materials [2]. The information can enter through two gates into working memory: sensory and long term memory. During recalling an event, the saved data will back to the working memory again to represent the former information. People with disorder in working memory are only able to do their part of daily functions which do not include the cognitive needs vastly. As a result, they do not have ability of doing multi assignment tasks [9]. The term cognitive rehabilitation is including the vast therapeutic methods being achieved by different rehabilitative experts. Many these experts apply cognitive methods to recovery their patients. Carf (1999) has given a definition of cognitive rehabilitation including the whole given activities focused on the performance which their targets are being done in relation to boost the cognition mechanisms and compensate the neural systems. In this cognitive rehabilitation, we are confronting with two main approaches: compensatory and therapeutic approaches. It should be noted that the separation of these both approaches never take place practically and their overlapping is inevitable in therapeutically issues. In this approach the main aim is to make some changes environmentally and remove any personal restrictions. These three targets of therapy recall ergonomically cognition concepts based on processing data leading to reduce working memory challenges as well [18]. The approach of cognitive therapy is a struggle to return the cognition capacities by practices and given target-based stimulants to make better person functions [18]. A care giver registers the obtained data through the sessions including correct responses and speed of achieving assignments. When overcoming on a task, the care giver increases the degree of the task [16]. The weaknesses of the cognition issues are stepping evolutionary at early adulthood.

Although the collapse of the brain is evolved in them but the brain can make it up by nurturing the neural nerves. In addition, some of these weaknesses can come from the lack of special skills instead of old aging biology. If the growth flexibility can be happened at old age, the interventions should be reduced [4]. Many researches carried out about the stroke, brain traumatic event and patients with Demanse showed positive results from achieving these techniques [1]. According to the reduction happened because of the disorder in working memory, the optimization of the cognition functions can increase daily life issues and a new based affairs in relation to achieve them can be effective approach in this regard. So, the main purpose of the present study is to review the effectiveness of cognitive rehabilitation on the working memory of patients with mild cognitive impairment.

MATERIALS AND METHODS

The related research is an experimental type with pre-test and post-test with control group. In the group of experimental design receiving memory rehabilitation intervention is being compared with control group in the wait list.

Subjects:

The present research community is subjected to the whole referred people to brain and neural clinics in 2012. About 40 one were selected based on available samples randomly in two groups of experimental and control. The base of

selection was referred to the diagnosis of mild cognitive impairment through neurologist and clinical evaluation by a psychologist based on MMSE score lower than 25 and Wechsler memory test. The variable of control group in this study, is subjected to having 55 year old higher, at least below Diploma, and not having neurological, psychological and psychiatric disorders and any movement-sensory dysfunctions according to the mood of a nurse and medical profile. Both groups were evaluated cognitively at first. The experimental group were evaluated 12 sessions weekly two times a week about 1.30hr a day. Finally, both groups were evaluated efficiently. After ending up the whole interventions, the related results were assessed by Mancova statistical test (15 ones in experimental and 15 ones at control groups).

Research tools:

The questionnaire of mental summary evaluation MMSE:

This is a full application sifting test which made by Folstein et al in 1975; the aim of making the tool is to diagnosis the patients bed into hospital but its main usage is subjected to evaluate patients cognitive abilities. These tests were called sifting tools. The summary evaluation of patients is the most common way of sifting in the world has been translated into many languages. This questionnaire evaluates the functions of orientation, language, attention and concentration, calculation, recalling, construction and perception. The maximum score of the test is 30 and score below 25 representing the probable destruction of cognition and score 20 below is subjected to a certain destruction in this regard. In a cross-sectional study, the summary evaluation of old patients at Tehran megacity has been carried out; the results indicated that the reliability of the test was satisfactory ($=0.78$) and in cut point 21 sensitivity was 90% particularly obtained at 84 % of the patients. The score correlation along with age and education level was 0.05 significant.

Wechsler Memory Scale (WMS):

The related scale is the most common test for adults' memory. This scale is the born of 10 years frequent experiments to develop the speed, simplicity, and practical based issues of the test. This test led by David Wechsler in 1945 at Blue year Hospital of New York City. The related scale has two A and B forms and each form including seven items and different topics of personal and public information, orientation, mental control, logical memory, number iteration, visual memory and recall learning. The scale has been normed by MR. Serami in Iran in 1993.

In Serami's study, a sample of 1007 ones ranging from 20-64 in 9 age groups were established and studied. In this study the validity of the test was obtained by Cronbach alpha 85% and the reliability in internal assimilation and factorial analysis and connotative results were acceptable, too. The obtained results show the features of the scale coincident with other carried out researches.

Task of N-Back:

This test is applied for evaluating the working memory. It is related strongly with the executive actions in terms of task of measuring cognitive function including the whole manipulating information, too. This test is mostly relied on the cultural issues. In the test the number of visionary stimulant is serially subjected to 300 mille/seconds on the monitor. And the subject should press the key when sees a similar stimulant; but if he or she did not observe the same stimuli pressing key 2; the time distance given in each picture is 2s. N-Back is a well-known test in photography and electrophysiological studies which is achieved on working memory. In the test a Seri of items is given to the subject such as letters, words and symbols or pictures...

And then he is asked to decide about each of these items whether these items are related to the features of the item in n step or no? Today, researchers prefer to apply N-Back test at their studies because this method is measuring the actual process of maintaining and controlling the information. (Chen et al 2008). The method of giving each item is related to and suitable with given target-based stimuli recorded in the memory. However, when N increases the maintenance and control of data will change semantically. The step of 1-back refers just to maintaining one stimulus by a person. In addition to this, when a stimulus replaces for a new one, updating is a necessary rule in the memory; hence, in task -back the subject should keep and protect the only one stimulus in working memory. The design of n-back task is that people have to respond to the whole stimulants. Therefore, this task requires an update frequent control at working memory. In this test a one hundred collection of linear pictures has been used.

RESULTS

Table 1. Descriptive indices of both variables before and after test

Group	Tool	Step	Variable	M	Dev
Experiment	N-Back1	Post-test	Correct answer	15.2	7.570
			Total time	243.766	161.457
		Pre-test	Correct answer	21.857	4.312
			Total time	250.143	190.937
	N-Back2	Post-test	Correct answer	8.133	3.719
		Pre-test	Total time	350.626	202.243
Control	N-Back1	Post-test	Correct answer	15.466	8.659
			Total time	269.915	153.983
		Pre-test	Correct answer	17.533	7.189
			Total time	315.420	290.987
	N-Back2	Post-test	Correct answer	6.4	4.339
			Total time	345.801	184.001
		Pre-test	Correct answer	8.666	4.029
			Total time	264.979	64.583

In order to study the effectiveness of rehabilitation on working memory, the related variables were measured based on both N-Back1 and N-Back2 before and after the test which have been shown in table 1. As shown the mean variables have been some extent increased; of course significance or insignificance of the differences has been specified in continue.

Table 2. Results of box for the variables covariance matrix in different groups

M box	F	Df	Df	Sig
50.329	4.215	10	3442.467	0.0001

The covariance analysis was used to respond the hypothesis. Pre-test scores of both groups were relied on the real time as well as post-test time; based on this, differences of both groups were evaluated after pre-test. At first, the pre-assumption of covariance matrix with M box was studied (Table 2). Results represent that the lack of establishment of this presumption is into the data. ($p > 0.01$); so, in multi variable tests the results reported one of these conservative tests.

Table 3. Results of Levene's test for the equality of variances in both groups

Tool	Variable	F	Df	Df	Sig
NBACK1	Correct answer	0.218	1	27	0.644
	Total time	1.944	1	27	0.169
NBACK2	Correct answer	4.442	1	27	0.044
	Total time	1.333	1	27	0.258

Louin presumption based on group variances equality is confirmed at the community. The confirmation of the variances presumption in the community meaning that the distribution of the working memory scores are equal together in both experimental and control group which has been given in table 3. In this analysis, pre-test scores have been considered under control group. That is, the effect of pre-test scores has been copied from the working memory and then, they will be compared based on the left variance which can accept the equality of variances in pre-test of variables among groups ($p > 0.01$).

Table 4. Results of multi variable tests to compare both groups in linear combination of scores at pre-test variables

Factor	Effect	Value	F	Hypothesis Df	Err Df	Sig	Separation otai
Group	Pillai's Trace	0.484	4.704	4	20	0.007	0.484
	Wilks' Lambda	0.515	4.704	4	20	0.007	0.484
	Hotelling's Trace	0.940	4.704	4	20	0.007	0.484
	Roy's Largest Root	0.940	4.704	4	20	0.007	0.484

According to the results of M box test, the result of multi variance analysis of Pillai's Trace is suitable for any report in this case. Based on the significance of Pillai's Trace, it can be stated that both variables in linear combination of significant dependent agent indicate that both of them are significant. According to table 4, it can be concluded that,

the group difference is significant in each variable separately ($p>0.01$). So, it can be said that after removing the effect of scores in pre-test at linear combination has differences between both groups. Moreover, based on Partial Eta Squared, it can be stated that about 48% of these changes can come from the scores linear combination of pre-test scores relating to experimental practice.

Table 5. the single-variance analysis to compare both people in each variable.

Source	Tool	Variable	Total	Df	Mean	F	Sig	Square
Group	NBACK1	Correct answer	146.630	1	146.630	12.125	0.002	0.345
		Total time	9883.776	1	9883.776	0.228	0.637	0.0098
	NBACK2	Correct answer	165.607	1	165.607	11.914	0.002	0.341
		Total time	42903.643	1	42903.643	3.770	0.064	0.140
Error	NBACK1	Correct answer	278.122	23	12.0922			
		Total time	994457.50	23	43237.282			
	NBACK2	Correct answer	319.704	23	13.900			
		Total time	261713.29	23	11376.839			

The results of table 5 indicate that after removing the effect of post-test, both variables of pre-test scores had only significant difference in response variable for both N-Back1 and N-Back2 ($p<0.01$). Based on the Partial Eta Squared given in the last column of the table, it can be said that in response variable about 34% of agent variance has originated which is related to experimental action. Because we want to just work with both groups, there is no need to follow-up test and a simple comparison of balanced means at both group were specified based on table 5. These means were given in table 6; based on table 5 it can be stated that in response variable both groups were significant so that the mean experimental group is higher than control group ($p<0.05$).

Table 6. The balanced means of both groups in scores of pre-test variables at both methods

TOOL	VARIABLE	Group	M	Dev Err	CI 95%	
N-Back 1	Correct answer	Experimental	22.014	0.943	20.063	23.965
		Control	17.386	0.910	15.503	19.269
	Total time	Experimental	264.256	56.393	147.598	380.914
		Control	302.247	54.428	189.654	414.841
N-Back 2	Correct answer	Experimental	14.302	1.011	12.210	16.393
		Control	9.384	0.975	7.365	11.403
	Total time	Experimental	329.642	28.929	269.796	389.488
		Control	250.489	27.921	192.728	308.249

DISCUSSION AND CONCLUSION

The percent of changes and the size of measured effect in working memory represent that there is a considerable difference between groups acceptably. Therefore, it can be pretended that the cognitive rehabilitation has been effective in the recovery of working memory. This finding is similar with other researches of other countries. This also has considerable results in the function of old people potentially by the intervention of MCI. The cognitive intervention may be effective for people with MCI; because these people can keep new navigator methods for their abilities; when the related intervention is designed effectively, it will reduce the worse effects of the MCI and their handicapped issues. Hence, these interventions programs can lead to better life quality, too [3]. The results of the research represent that these interventions can also be effective in recovering working memory of people with mild cognitive impairment. This conclusion shows that the cognitive rehabilitation may be effective in people with MCI and their beginning disability; in recent years, many studies have been evaluated the effectiveness of cognition practice in MCI; these studies show that these practices can be objectively effective in cognition experiences [3]. This conclusion is not coincident with the researches of Beulaville, 2007, Cipriani 2006, Rozinni 2007, Talassi 2007, Gunter 2003; also, it is not coincident with other few researches such as Clare 2005, Brooks 1999, and Rap 2002. The present study in Iran has been firstly carried out as introduction and it is better study the experimental designs in various age groups. In the other hand, because of applying computer in this study, it is better carry out the study on the illiterate people; hence, based on the findings, the necessity of cognitive rehabilitation has been strongly dominant on the related people due to the possibility of transferring from Demance to Alzheimer being conducted by experts in this regard.

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