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Application of Neuro-Cognitive Assessment and Rehabilitation (NCAR) Computerized Test in Working Memory Deficit in Parkinson

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Abstract Patients with Parkinson have working memory changes, so they need rehabilitation and treatment is required for them. The purpose of current study is to determine the effect of neuro-cognitive rehabilitation computerized test on these impairments. The present cross-sectional study was conducted on 120 patients with Parkinson and neuro-cognitive rehabilitation computerized test were used for assessment (before) and rehabilitation (after) in patients in 15 minutes. Before and after neuro-cognitive rehabilitation, a significant difference was identified in neuro-cognitive rehabilitation computerized test' scores (P<0.000). This technique can rehab in Parkinson with working memory disorders associated with neurological conditions to facilitate the acquisition.

Keywords: *neuro-cognitive, assessment, rehabilitation*

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1. Introduction

Working memory is a theoretical concept in neuroscience and cognitive psychology. The studies of Neuroscience have shown the relationship between working memory, learning and attention. There are theories regarding the theoretical structure of working memory indicating that certain parts of the brain are involved in working memory. The studies have determined that the areas of the brain frontal cortex, parietal cortex, anterior cingulate, and parts of the basal ganglia are involved in the working memory. Working memory is a system that stores passing information in mind actively and it can also be manipulated [1,2]. This system includes stored subsystems and manipulated visual images and as an administrative center coordinates subsystems. The system includes a visual representation of possible movements. Working memory needs to supervise especially in some parts of processes which involve in the completion of the activities related to the cognitive interferences [3]. Required cognitive processes to achieve this target include: Executive functions and attention from short-term memory, which cause temporary integration, processing, disposal and recovery information. These processes change in different diseases including Parkinson disease (PD) and they are sensitive to age, and working memory is related to the cognitive evolution and also researches have shown that its capacity varies depending on age. Determination of the role of age, sex and education factors on memory is vitally important for designing neuro-cognitive test and these factors can determine the ability to assess the capacity of patient's working memory [[3,4], p.1]. Comparing the results pattern of mentioned test in both sexes at different ages and various educations is associated with working memory abilities, and this comparison determines cognitive strengths and weaknesses of this cognitive field.

Working memory rehabilitation is also associated with diverse cognitive approaches [5]. In recent years there has been some basic evidences regarding the usefulness of different techniques for rehabilitation. There is also evidence of rehabilitation-induced plasticity [6,7,8]. The measures which have already been evaluated in this field include the systematic rehabilitation techniques such as the disappearance of symptoms and no error rehabilitation methods. Most studies have reported positive results in favor of systematic rehabilitation. However, issues related to the design and implementation of effective method is not clear and further studies are needed. Examining the evidence has been accompanied with clinical recommendations based on training and also asking physicians for inclusion of these methods to study the memory impairment in these patients. Implementation of effective methods of memory rehabilitation will facilitate linguistic-cognitive rehabilitation [9,10]. In addition to the improvement of the results, there are pragmatic benefits to support evidence-based rehabilitation practices. At the beginning, some criteria were created for the method and applying the evidence-based guidelines [11], some

examples of these criteria were identifying critical factors for scientific clinical decision making [12]. Some priorities were developed for functional guidelines domains as well. Up to now, many evidence-based guidelines in clinical domains are presented such as: using direct attention exercises [13], using external method for managing memory impairment [10], using standard evaluation of traumatic brain injury [14,15], behavioral measures [12], and measures for executive function [11].

We obtained the protocol of this model after studying the evidence and chose Parkinson's patients in order to make the results of the research inclusive and also evaluate the evidences related to the people with performances derived from cognitive-linguistic disorders. These target population is complex and heterogeneous group that their cognitive, communicative and behavioral impairments interfere with each other interactively and are affected by variable environments in different ways. Among these patients, memory impairment is typically a symptom of the disease. Memory disorders in these patients had no certain same conditions in comparison with the previous studies [12]. This study investigates a model of memory rehabilitation in patients with Parkinson's disease. The purpose of this study was to evaluate the patient's memory after memory rehabilitation with this model [13].

In the study we applied this protocol to investigate the guidelines and all the counterpart studies were considered in order to achieve one of the expected purposes of the study which is to identify the effective rehabilitation functions in cognitive rehabilitation of memory [13]. In order to make results of the research inclusive and also assess the existing evidences related to the people with cognitive-linguistic impairments, in this study we decided to do studies in the population. The clients were suffering from Parkinson, and the target population introduces subcommittee guidelines, complex and heterogeneous groups that their cognitive, communicative, and behavioral impairments interfere with each other and are affected by variant environments in different ways. As the memory disorders in patients with Parkinson had no certain consistent conditions similar to previous studies, it is really important to take into account other sources to study rehabilitation methods [16]. Cognitive neuroscience studies generally are supported by polygonal models of working memory, such as Baddeley model. However, memory models mostly focus on functional details rather than structural ones. Recent studies have found different origins in the brain about working memory activities. For example, Haddon Viuos' findings show that each of working, verbal, visual, spatial, and executive memories is linked with different parts of the brain [17,18]. Other neurological examinations have also found evidences on the separation of verbal system electrical flow from visual-spatial. The first results of the neural pathways and neurotransmitters of working memory, which are derived from animal studies first showed that lesions to the spatial PFC cause impairs in working memory performance in monkeys. Several primary models such as Baddeley model turned to be the founder of computerized models in working memory and computerized models were proposed by some other researchers from different countries as well [19,20,21,22,23].

2. Methodology

2.1. Purposes of Study

In this study we are also trying to assess of application of Neuro-Cognitive Assessment and Rehabilitation (NCAR) computerized test in working memory defect in Parkinson disease and this test was based on three main variables: age, sex, and education.

2.2. Participants

The sample randomly consisted of 120 patients (according to the pilot study) of Parkinson disease (Response Rate: 100%) who visited the outpatient neuroscience department. The patients were in the age group of 40-70 years, of both sexes (60 male, 60 female).Patients were from Parkinson clinic of Shohada hospital in Shahid Beheshti University MC, Tehran-Iran. And research has done at department of Neuroscience, Functional Neurosurgery Research Center and patients precipitated to the research after filling consent form.

2.3. Measures and Procedure

We used a Computerized Working Memory Task (CWMT) for data collection. At first, some information about the implementation of test will be given to the individual and then he should click on page or press space or enter button on the keyboard to start the task. In this test there is an 8*8 matrix in every stage which only one box is on in each row and column of this matrix (its color is different). After 5 seconds, the matrix is rotated 90 degrees clockwise and the user should recognize that the new matrix is the same matrix as before or a new matrix is shown to him. In the case of being the same, he should press left shift button or press the left arrow on keyboard; and if it was not the same he should press right shift or right arrow button on the keyboard. If the answer was correct, the word correct will be displayed to him, and then he gets the chance to go to the next step. But if he does it wrong, incorrect word will be displayed to him. This process continues until the user press the Close button to exit the test or continue up to step 50, which is the last step in the test and its window will be automatically closed

Times in test:

- The time of showing the Ready Phrase at the beginning of the task: 2000 Millisecond
- The time of showing each step: 5000 Millisecond
- The time of showing Correct or Incorrect phrases: 2000 Millisecond
- The time when the user has the opportunity to respond to the each stage: 10000 Millisecond
- Total time to do the task is considered 15 Minutes, the user then has the opportunity to implement the task up to end; otherwise it will be automatically closed after 15 minutes.

Variables of test:

- the number of correct responses (Correct Response)
- the number of error responses (Error Response)
- total time of correct responses based on Millisecond (Correct Time)

- total time of error responses based on Millisecond (Error Time)
- last step the user has done (Last Level)
- total time of task execution based on milliseconds (Time Rec)

Results of test:

After doing computerized test, data will be entered into $SPSS_{18}$ software and they will be analyzed through descriptive statistics and Pearson correlation coefficient tests and t-test. The assessment tasks are known as "digit capacity" or digit span when the numbers are used. Memory capacity is a common method for measuring the short-term memory. It is also some part of the cognitive abilities test. Lagging memory capacity is a variety of challenging which includes remembering domains in reverse order. From functional point of view, it seems that the memory capacity will measure some discrete units in which a person can distribute his attention sequentially and also organize them into a work unit. In general, memory capacity refers to the ability for immediate reproduction after presenting a series of discrete stimuli which are in their original purposes. Practically every kind of stimuli may be offered, such as numeric, letters, words and sounds, and almost every sense organ or combination of the sense organs are likely to be used to perceive it.

It is hard to make a structural definition of memory capacity and the confronted individual gets involved in the differences between the requirements of memory capacity and the actual processes. “Associability” is required in the memory capacity, and this term refers to the ability of a set of elements together; and understanding relationships between them is a means of reproducing them better. Images are the other process involved in the memory capacity. This issue which has been presented in order to increase this set should be able to image the series. The actual reproduction of some sets of stimuli includes the process of memory. The reproduction would be impossible if the individual does not have any memory at any states. It is well known that the memory capacity and memory at the time of production varies. Although the memory capacity is temporary; the memory is relatively permanent. Moreover, the amounts of components that are involved in memory capacity are usually much less than the amount involved in the memory. Producing the sets would make other "production factors" such as language ability and math skills involved. Among the groups providing rehabilitation approaches, there are variant and different rehabilitation approaches. Many studies provided sufficient details to repeat the experiments [24,25,26]. Many studies have focused on the rehabilitation of components, which from researchers’ point of view can increase the active processing of participants about the target information/ approaches and at the same time minimize the errors. These components appear as strategies (e.g. verbal descriptions, images, predictions - reflection, assessing questions/ auto responses) or emphasize on stimulus manipulation (e.g. examples of different rehabilitation for target information/ staging before exposing stimulus). In short, previous studies’ findings express that systemic rehabilitation approaches would cause longtime/ flexible skill and information acquisition. In addition, the results of studies measuring distribution emphasize on the importance of specific rehabilitation components so that support the "fixed" acquisition of skills and knowledge, maintenance and distribution to "real life" and individual meaningful contexts. In general, researches’ findings support the effects of systemic guidelines. However, details of the design and implementation the guidelines are not clear and further studies are needed. Rehabilitation is a complex issue and interaction among destination rehabilitation goals and profiles of learners are not well understood. The studies indicate that systemic guidelines techniques are useful for people who are suffering from defects in memory, and determine the most effective variant components related to rehabilitation task, and also prove that the cognitive rehabilitation and participant characteristics requires dynamic information about each client. However, this study shows topics or practical guides that can be applied to assist practitioners in the field of design, evaluate and modify their instruction based on client performance [27].

Key variables of rehabilitation in test include:

Training: which is one of the dominant issues in researches and is needed for the rehabilitation conditions and increasing the reinforcement processes to facilitate the rehabilitation and distribution. That is to say that stimulus variable can help and facilitate training. Components of the strategy (e.g. oral description) promote the reinforcement processes that can lead to improved attention, decode and organize while achieving and also facilitate explicit recovery [28,29]. However, these components are also encounter with the risk of recall errors increase. So making balance between restrictive errors, and reinforcement/ incentive processing for accurate rehabilitation projects is critical [30,31]. Strategies: If we emphasis on multiple versions of rehabilitation [30,31,32,33] or the stimulation improve through other means before the display of stimulus [34], the studies would found a part as "trigger variable". Interventions would include techniques such as verbal description, photograph or individual responses [31,35].

Repeat: Another variable of the memory rehabilitation is providing adequate repeat and exercise. Reviewing the previous studies, we found out that there is a specific procedure indicating the fact that the more practices, the more stable rehabilitation; and their goal is implementing the multistage methods (e.g. data entries, extra usage of external memory) and in all of them, except for one program, a high need for rehabilitation was prescribed that continued from at least 6 up to 30 sessions or more [24,26].

Spacing or distributing practical test: (i.e. the spacing recovery/ rehearsing) is another rehabilitation’s key variables. This finding has well been proved in existing papers and literature on healthy subjects and those with defects in their memory due to dementia [3]. Hooper and colleagues examined 15 studies in which participants would learn some or all of the target information taught within the recovery intervals. Another study has investigated the spaced recovery or presentation in people suffering from brain injury, so that the desired results have been achieved [14,36,37]. In addition, findings from other studies involving spaced recovery/ distributed practice as part of no error rehabilitation or systemic guidelines package indicated the desired results [35,38].

Both the abundance and distribution of functional testing will help to become dominant on target skills and information; and this would be necessary when a person

allies the skills/ information in his daily life. A "dominance criteria" is to determine the comparative performance levels (e.g. accuracy, independence, time frame) that is assign of such a dominance. For example, a clinician and a patient can determine the achievement of this dominance after data entry is done about three times in a row and with 100% accuracy. In this overview, the majority of measures have been introduced no criteria for dominance because the basic questions of the study was to determine whether a specific guidelines will work, and/ or a specific method is better than the other methods, or not. In other words, dominance on information/ skills has not been always the primary goal. Most of these studies indicated positive results which were often including many rehabilitation prescription and practical experiment distribution mentioned before [32,38].

Ecological validity: The specific importance for clinicians is evidences that support the ecological rehabilitation. As previously explained, our rehabilitation objectives from ecological point of view would be considered valid in the case that could be replaced instead of the information or skills that study participants would use in their daily lives. Range of objectives extended from face-name to remembering the people involved in training using external memory or computerized work as well as academic skills. Among these studies, 100% indicated positive findings. This high percentage of positive results supports[1] suggestions that indicate the work variables, such as motivational and emotional significance, help to longer stay of memories in mind. Specifically, evidences suggest that the rehabilitation may be facilitated when the tasks or information are inherently practical to the individual. Another processes in the subset of ecological studies was this that all medical prescriptions (with at least six therapy sessions) and the entire work analysis for training approaches were clear and determine rehabilitation purposes for the participants. No clear relationship observed between the reason of memory loss and response to rehabilitation methods in the analysis of demographic groups. It can be said that systemic training are effective and useful for individuals with memory defects in different ways, and this means that the examination of different patients for the assessment of rehabilitation practices will be fruitful. Of course, as previously mentioned, the results were less clear for people suffering from dementia; many of these studies had adequate therapeutic effect. Among the study's findings which were adequately addressed in the etiology of the disease, different results were reported for different memory-intensity levels [28,39]. Researchers' studies (2000) in this case are a clear example. They showed that participants who have weaker memory benefit more from gradually clues removing. However, participants who have a stronger memory may require the clues to be removed faster. Moreover a number of studies [31,40] suggest that no error rehabilitation may be useful in severe defects' level memory. It is still uncertain that how severe memory defects are effective on choosing a specific rehabilitation practices.

2.4. Data Analysis

After completing demographic questionnaire and performing the working memory test by participants, Significance levels are bilaterally and statistical significance was set at 0.05. The statistical program used for analyzing the data was SPSS 18.0. Statistical analysis of this study was done through descriptive statistical tests, Pearson correlation coefficient and the t-test. Comparisons of frequency, mean, standard deviation, standard error of the mean variables to test working memory were done in patients with Parkinson disease before and after rehabilitation. We evaluated t value with the variables working memory test in patients with Parkinson before and after rehabilitation.

3. Results

Table 1 show descriptive analyses demonstrated that 50% of patients were female and 50% male, they were aged 40-70 years. Regarding educational level, 40% of patients were illiterate or primary school graduates, 17% high school graduates, 29% had diploma and 14%had bachelor. Finally, most patients (72.5 %) were in the age group 60 to 70 years.

Table 1. Demographics of Parkinson's patients

Variables		Number	Percent
Sex	Female	60	50 %
	Male	60	50 %
Education	illiterate or primary school graduates	48	40%
	Under diploma	20	17%
	Diploma	35	29%
	Bachelor	17	14%
Age groups	40-50	12	10 %
	50-60	21	17.5%
	60-70	87	72.5 %

Table 2. Comparison of before and after rehabilitation

Variable	Group	Mean	Standard deviation	Standard error of the mean
Correct response	After rehabilitation	15.68	15.19	1.38
	Before rehabilitation	4.28	12.77	1.16
Error response	After rehabilitation	4.17	10.80	0.98
	Before rehabilitation	12.78	2.16	0.19
Correct time	After rehabilitation	1.59	39900.85	3642.43
	Before rehabilitation	4.01	40862.98	373030.26
Error time	After rehabilitation	2.72	81502.81	7440.15
	Before rehabilitation	5.94	25270.31	2306.85
Last level	After rehabilitation	6.43	20.40	1.86
	Before rehabilitation	27.12	2.96	27084
Time record	After rehabilitation	2.97	2.20	20156.69
	Before rehabilitation	9.63	49467.52	4515.74
Memory span percent	After rehabilitation	54.21	40.85	3.72
	Before rehabilitation	16.45	10.59	0.96

In particular, Table 2 shows the patients had done task and variables of task improved in correct response from 4.28 to 15.68, Error response decreased (4.17) in the after rehabilitation, also correct time increased and error time decreased. These data showed the patient improve in correct response but a long time and decreased error response with a short time. In this table, Last level (6.43) is low after rehabilitation and it confirmed patient fatigue. We know that PD introduces fatigue with their activity. Time record is important for storage of memory and it is short with rehabilitation (2.97). Finally memory span percent has been increased after rehabilitation (54.21).

In Table 3 show significant (0.000) for all of working memory test variables in patients with Parkinson before and after rehabilitation.

Table 3. Evaluation of the significance T value, the variables tested working memory in patients with Parkinson before and after rehabilitation

Variable	F	Sig	t	df
Correct response	61.63	0.000	6.40	231.17
Error response	123.22	0.000	8.56	128.50
Correct time	24.32	0.000	4.65	237.86
Error time	24.89	0.000	4.12	141.67
Last level	862.06	0.000	10.99	124.02
Time record	352.14	0.000	9.74	130.91
Memory span percent	576.73	0.000	9.80	134.93

In Table 4 present significant (0<0.05**)** for all of working memory test variables with age in patients with Parkinson in after rehabilitation. According to the table, All variables testing working memory rehabilitation have significant P-value relationship in positive direction with age (p<0.05) after rehabilitation. There is also significant relationship between error time variable and age in negative direction (p<0.05) before rehabilitation.

Table 4. The comparison of p-value and correlation of age with variables working memory test in patients with Parkinson before and after rehabilitation

Age	After rehabilitation	Before rehabilitation
Correct Response	r=0.280 p-value=0.002	r=0.145 p-value=0.114
Error Response	r=0.447 p-value=0.000	r=0.135 p-value= 0.142
Correct Time	r=0.510 p-value=0.000	r= 0.093 p-value=0.315
Error Time	r=0.361 p-value=0.000	r= -0.316 p-value= 0.000
Last Level	r=0.448 p-value= 0.000	r=0.096 p-value=0.297
Time Record	r=0.463 p-value= 0.000	r=-0.061 p-value=0.509
Memory Span Percent	r=0.447 p-value= 0.000	r=-0.064 p-value=0.491

Table 5. The comparison of correlation, significance of sex with Variables working memory test in patients with Parkinson before and after rehabilitation

Sex	After rehabilitation	Before rehabilitation
Correct Response	r=-0.036 p-value=0.001	r=0.299 p-value= 0.001
Error Response	r=0.101 p-value= 0.271	r=0.079 p-value=0.394
Correct Time	r=0.035 p-value=0.003	r=0.269 p-value=0.003
Error Time	r=0.121 p-value=0.186	r=-0.011 p-value=0.905
Last Level	r=0.049 p-value=0.095	r=0.120 p-value=0.190
Time Record	r=0.075 p-value=0.003	r=0.268 p-value=0.003
Memory Span Percent	r=0.049 p-value=0.002	r=0.283 p-value=0.002

According to Table 5, the variables of Correct Respon , Correct Time, Time Record and Memory Span Percent of working memory test have significant P-value relationship in positive direction with sex in before and after rehabilitation (p<0.05).

According to Table 6, there is a relation between the variables of correct time, Error Time and time record with education in the negative direction after Rehabilitation and there is a relation between last level variable with education in the positive direction before rehabilitation (p<0.05).

Table 6. The comparison of correlation, significance, and p-value difference of education with Variables testing working memory in patients with Parkinson before and after rehabilitation

Education	After rehabilitation	Before rehabilitation
Correct Response	r=0.018 p-value=0.842	r=0.091 p-value=0.325
Error Response	r= -0.122 p-value=0.186	r=0.149 p-value=0.104
Correct Time	r=-0.180 p-value=0.049	r=-0.019 p-value=0.836
Error Time	r=-.160 p-value=0.080	r=-0.135 p-value=0.143
Last Level	r=- 0.063 p-value=0.491	r=0.182 p-value=0.047
Time Record	r=-0.184 p-value=0.045	r=-0.025 p-value=787.
Memory Span Percent	r=-0.063 p-value=0.491	r= 0.104 p-value=0.258

4. Discussion and Conclusions

By raising our understanding about effective methods for memory assessment and their implementation, we can facilitate the memory rehabilitation. In addition to improve the rehabilitation outcomes, there are some pragmatic benefits to support evidence-based rehabilitation practices. In economic difficulties, cognitive rehabilitation is considered as a well designed guideline and the key for facilitating the efficient and sustainable positive outcomes in the patients with memory impairments. Up to now the role of factors like age, sex and education in working memory test has been evaluated based on different variables [13]. Different researchers' models, such as baddeley include some different factors[1]. According to model factors, the role of factors like age, sex and education in working memory tests have been evaluated based on different variables[1]. Recent researches have determined the fact that the efficiency of working memory process depends on individual differences or diseases in working memory capacity.

As age grows the executive working memory establishes a stronger link with verbal working memory and also establishes fewer links with Visual-spatial functions [40]. The phonetic short-term memory has the last link with executive working memory. The capacity of phonetic memory increases even without any coincidence increasing in executive working memory. Although these methods help to assess and train working memory and many studies have been successful in working memory training, these studies have little experimental results [41]. However, there is a strategy focusing on specific points of strength and weakness of working memory specifications [42].

This study assesses the working memory rehabilitation in patients with Parkinson's disease. The techniques

applied here involve personal and face to face assessment of working memory rehabilitation. This is a non-invasive method to assess which will be done in a comfortable and private outpatient office and can determine memory capacity that is maintained or dropped at any age. The rehabilitation will be proposed when signs or symptoms of working memory problem exists. This rehabilitation is sensitive to poor memory and thinking problems that might not be revealed from the other way and in the case of mild memory problems; neuro-cognitive tests of memory may be the only way to detect them. This test is really valuable for the rehabilitation of memory problems [22].

Our aim in this study is assessing of the computerized model of working memory rehabilitation based on three main variables of age, sex and education in these patients. The computerized model of working memory rehabilitation may be the only way to detect them. These tests can be also used to identify problems related to medical conditions that can affect memory and thinking, such as Parkinson's disease, diabetes, high blood pressure, brain hit, Huntington's, fibromyalgia, stroke, kidney disease, cognitive decline after surgery, alcoholism, etc. This model helps to distinguish memory disorders in diseases such as Alzheimer's disease, strokes, dementia, depression and anxiety and is also used for the managing more effective treatment including medical and non-medical cure [8,10,14]. Test results from these tests can be applied in order to schedule the treatments using strengths points to compensate for weaknesses. The results of these tests can lead to identify the existing memory problems and also detect useful strategies. For example, these results can be used for planning and supervising on the cognitive rehabilitation or memory skills recovery after a stroke or traumatic brain injuries. Distinguishing the fact that weather or not the factors including age, sex, and education play any role in cognitive abilities of normal individual is important, and also they can accurately identify the working memory capacity. Comparing the pattern of these results with the capabilities before injury and correlating the results with trauma, Will lead to confirm the diagnosis of brain injury and determine an individual's cognitive strengths and weaknesses.

The cognitive-linguistic rehabilitation will be facilitated by raising our understanding about effective methods for memory rehabilitation and implementation of them[42]. The current model in economic difficulties, cognitive rehabilitation is considered as a well designed guideline and the key for facilitating the efficient and sustainable positive outcomes [42]. Our study concentrate to similar variable of last studies for rehabbing especially articles that have been published in the 1980s and early 2010s, focus on this main question that whether a particular systemic rehabilitation method has been effective or has led to better performance compared to other methods (MVC [17]; EL versus EF [43]).

Last studies such as our method indicate to optimal rehabilitation by using no error rehabilitation methods, the method of removing clues, interval rehabilitation, or systemic rehabilitation package will be happen. Favorite results have been obtained in all demographic groups which the strongest result, as it was predictable, belonged to dementia population and these results may be slightly different from the results in patients with Parkinson's disease.

In another studies showed negative results [44]. In our study subjective group were not from this age group. The other researchers worked on dementia, they showed positive results [35,44], while some of studies suggested sufficient results in rehabilitation [45]. The researchers achieved sufficient results in their studies and reported immediate desirable results [45,46,47].

Some of studies reached to incomplete or complete distribution goals of rehabilitation. For example, in a study by Ehlhardt and colleagues [38] when the participants were able to understand a little bit more complicated stages in sending emails, distribution for the rehabilitation process of email was reported. In other studies, laboratory findings were generalized to the real environment and circumstances, however, in some cases, training in a real environment, facilitated the distribution [24,32]. The researchers reported the generalization of remembering faces – names to a real environment in patients with memory deficit and using memory strategies in new situations for the participants. The Distribution in this study will be possible on condition that we enter more volume in the study because the results before and after rehabilitation were desirable (Table 3 and Table 4). The researchers pointed out that the assistant rehabilitation group has remarkably progressed in the review of selective distribution [48]. The maintenance results were obtained when the re-evaluation of goals occurred over a day after the train stopped. Researchers called this time as "maintenance".

Maintenance controls in the last studies were reported. They reported about the unfinished maintenance or 100% of the rehabilitation goals from a few days to nine months after the intervention [24,49]. The overall results of maintenance control reported positive [35,50]. The positive effects of treatment remained until six months after the intervention. The amount of prescribed treatment refers to the frequency and duration of treatment sessions, both in terms of sessions' length and the general time in which patients have been cured. Frequency of treatment ranged from single session to every day session; the number of hours of treatment differed as well. Some sessions lasted for 30 minutes and the other 2 hours. Some medical practices lasted a week and some took several months. Frequency of treatment varied in different situations from at least one treatment session to 16 sessions. The total duration of treatment ranged from one to four weeks. Half of the studies have focused on the therapeutic situation. These studies described a range of opportunities such as: experimental or clinical situations, workplace and home remedy through the phone [37]. Some of studies reported about treatment providers including examiner and family members as well as computerized stimuli which were mentioned in resent studies.

During the last 50 years the researches on the memory have been remarkably increased. Today, according to the new therapy methods of cognitive rehabilitation we can significantly improve the patients' life quality. Lack of attention to the new methods of memory assessment in communities and simply dependence to Pharmaceutical treatments may get patients encounter with the problems such as treatment costs and reduction in quality of life. Up

to now several researchers from different countries paid attention to the working memory assessment in patients with Parkinson's and designing the computerized model for it [51]. These assessments are non-invasive and inexpensive methods that will be conducted very easily in a private office. When there is slight memory impairment, computerized neuro-cognitive test of memory may be the only way to detect them.

According to the experience gained during this study, we hope to apply the combined approach in the future studies. The future studies focus on assessing the validity of previous approaches (e.g. EL before exposure – goods [47]; EL individual responses [31]). Accordingly, the results of future studies will be assessed focusing on the question that weather created rehabilitation method have been influenced by the same hypothetical promotion or not. The current study has also confirmed the rehabilitation through this model in patients with Parkinson's (Table 3). The results will be examined in all of age groups in order to total trends rehabilitation. Extensive analysis about the interconnected immediate results showed some supportive evidence to use the systematic rehabilitation methods which were the same as the results of our study.

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