

ARTICLE

COMPARISON OF CONSCIOUS AND UNCONSCIOUS MEMORIES AND SENSORY PROCESSING IN PEOPLES WITH SCHIZOPHRENIA AND MULTIPLE SCLEROSIS AND ALZHEIMER'S DISEASE

Hosein Ghamari Givi, Ali Sheykoleslami, Jahan Sadat Asadi Bijaeyeh*

Education and Psychology Dept., University of Mohaghegh Ardabili, Ardabil, IRAN

ABSTRACT

The purpose of this study was comparison of the conscious and unconscious memories and sensory processing in patients with schizophrenia, multiple sclerosis (MS) and Alzheimer's disease. Our research method was causal-comparative. Statistical population were patients with schizophrenia in Mirzakochak mental hospital and patients with multiple sclerosis and Alzheimer's disease that are kept by formal caregivers in welfare centers in Guilan or by informal caregivers in families in Rasht city of Guilan province in Iran. 45 persons with MS/ Alzheimer's disease and schizophrenia (in each group 15 persons) were randomly selected by accessible sampling method in 1393. Then, subjects were asked to response to Wechsler Memory Scale to assess Conscious memory and Stroop test for assessing of Unconscious memory and sensory profile questionnaires to measure of Sensory processing and then raw data were analyzed by multiple analyses of variance with using of spss16 software. P value less than 0/05, namely $p < 0/05$ was considered as significant. The result showed that there was significant difference between conscious memories/ unconscious memories and sensory. Conscious memory in schizophrenia was significantly better than the other two groups and multiple sclerosis was in the second grade. Unconscious memory in schizophrenia group was significantly better than the other two groups. In sensory processing the Alzheimer group was significantly better than the other two groups and the schizophrenia was lower than the other two groups. Conscious of Alzheimer in time of fourth card (mean=74/93, CI 95% =64/87 - 84/98, $p=0/005 < 0/01$) / unconscious of Alzheimer in time of 2th card (mean=54/78, CI 95% = 47/18-62/38, $p=0/001 < 0/01$) / sensory processing of Alzheimer (mean=48/80, CI 95% = 45/10-52/49, $p=0/001 < 0/01$) / had the maximum mean in three groups.

INTRODUCTION

KEY WORDS

Alzheimer; multiple sclerosis;
conscious & unconscious
memory; schizophrenia;
sensory processing

The diagnosis of schizophrenia has expanded in DSM-5 [1]. Criterion A now includes five items:

1. Delusions.
2. Hallucinations.
3. Disorganized speech (e.g., frequent derailment or incoherence).
4. Grossly disorganized or catatonic behavior.
5. Negative symptoms (i.e., diminished emotional expression or volition).

At least two of the five symptoms must be present for at least one month. One of the two symptoms must be delusions, hallucinations, or disorganized speech.

Criterion B for schizophrenia gets more attention in DSM-5: "Level of functioning... is markedly below the level achieved prior to the onset". This is not a criterion for schizoaffective disorder. (This is apparently unchanged from DSM-4.)

American Multiple Sclerosis Association [2], see that Multiple sclerosis is an immune mediated process where an abnormal response puts the immune system against the central nervous system including the brain, spinal cord and optic nerves.

Alzheimer's disease or senile dementia is a progressive and debilitating chronic brain disorder that is associated with profound effects on memory, intelligence and ability to care for themselves and a defect in speech, motor activity, recognition of landscapes and familiar people or dysfunction in planning, innovation, organizing and abstract reasoning. Diagnosing a person with Alzheimer's disease or the likelihood of developing Alzheimer's disease in an elderly person is fearful for her or his relatives and carers [3]. Usually "memory disorder" is the first symptom that arises. Memory refers to recollection of something from the past and it is usually done consciously. As recollection is the conscious process of retrieval, the cognitive psychologists call it explicit memory. Implicit memory appears when the performance on a task is facilitated in the absence of conscious recalling and this facilitation is measured by preferential effect. In the preferential effect process, the nodes that are launched through activity dissemination are activated imperfectly and thus are readily sensitive to the next activities [4]. Explicit memory is conscious and voluntary recollection of facts and events that is measured by using simple recall and recognition examinations. In contrast, implicit memory is the involuntary and unconscious form of memory, and refers to the knowledge that is not at the level of consciousness and through a variety of tests including stem of words and part-words completion tests is assessed [5]. Perhaps sensory processing is the most essential component of psychological that forms the base of how people perceive and react to environmental stimuli. New evidence shows that people process sensory information in different ways. This means that some people are more sensitive than others to have sensory information [6]. A number of investigators have suggested that unlike the normal elderly population, patients with Alzheimer's disease have a severe semantic-memory deficit. However, the semantic-memory tasks used in previous studies have been confounded by the heavy demands they placed on effortful processing. In the present study [7], 20 demented (mean age 71 yrs) and 20 normal (mean age 69.8 yrs)

Published: 10 October 2016

*Corresponding Author

Email: asadijahan70@gmail.com

elderly Ss were given a battery of episodic-memory tasks and 3 tasks that examined how intact and accessible their semantic memory was under conditions that did not require effortful processing. Although the demented Ss were greatly inferior to the normal Ss on the episodic-memory tests, they performed equally well on the semantic-memory test: The naming latency of both groups was equally facilitated by a semantic prime, the recall accuracy of both normal and demented elderly for a string of letters was similarly affected by the degree to which the string approximated English orthography, and recall accuracy for a string of words was affected equally in the two groups by the degree to which the word string obeyed syntactic and semantic rules.

In a study that was done by [8], the Early empirical studies in the field of memory loss in the early stages of dementia of the Alzheimer and evaluation these studies in relation to the new theory of memory in humans, it was discovered that: Whilst memory deficits are found to be widespread, some aspects are more resilient to impairment than others. For example, the processes associated with articulators' rehearsal in working memory are unimpaired despite a reduction in performance on most tests of primary memory. The "implicit" aspects of secondary memory appear to remain unimpaired, in contrast to a marked decline in "explicit" or "episodic" memory. In addition, there is evidence that the rate of forgetting from secondary memory is normal. Some aspects of episodic and semantic memory are found to be impaired as a consequence of a decline in the efficient organization and processing of verbal material at encoding or retrieval. It is concluded that the deficits share particular features found in organic amnesia, but with additional deficits which relate to impairments in other domains of functioning. [9] write in an essay under the title of « Auditory sensory memory impairment in Alzheimer's disease: an event-related potential study»: AUDITORY event-related potentials (ERP) were recorded from 10 healthy older subjects and 9 patients with Alzheimer's disease (AD) to investigate whether auditory sensory memory is impaired in AD. Standard (85%) and deviant (15%) tones were presented in random order with inter stimulus intervals (ISI) of 1 s or 3 s in separate blocks and conclude that/ the memory trace decays faster in the AD patients than in age-matched healthy controls. In studies that have been conducted on the clinical aspects of dementia/some features are registered and reported/ such as aphasia without viscosity speech/near memory disturbances and then distant memory/ Structural disorders/ also weakened the power of abstract thought, Calculate and Language difficulty in naming and finding appropriate words/with loss of functional words are reported. Also has been recorded some cases of vocabulary insufficiency/ and random use of words that already have "been used. Evaluation of kind of speech disorders in patients with Alzheimer's disease shows that repetition and adventitious use of integrity tools are the general characteristics of speech in these patients [10]. In a study that conducted by [11] with the aim of to examine the contribution of controlled (or conscious) and automatic (or unconscious) memory processes to the performance of a stem-completion recall task by persons with Alzheimer's disease and comparing them with a control group (control)/ the obtained results indicate the severity of impairment in the community dwelling demented patients'. Further, the estimates of the automatic processing were also found to be reduced, although there was considerable overlap in the performance of the two groups on this parameter. It was found that the residual capacity of Alzheimer's patients to recall previously learned information was supported to a substantial degree by their automatic memory processes. This finding can be very important for planning in the area of effective learning and development and growth of rehabilitation strategies. In a study about conscious and unconscious memory [12] Conscious and unconscious uses of memory and priming were studied in 30 patients with multiple sclerosis (MS) and 15 normal control (NC) subjects. MS patients were classified into two subgroups according to their cognitive status; 15 of them were cognitively deteriorated (the MS-D group) and 15 cognitively preserved (the MS-P group). A process dissociation procedure was used to separate conscious and unconscious memory performance in a word stem completion task. The results showed that the MS-D group had deficient conscious memory performance, but had intact unconscious memory as well as priming. The MS-P group showed normal conscious and unconscious uses of memory and priming. Thus, in MS-related cognitive decline, conscious memory seems to be vulnerable, whereas unconscious memory remains intact. The results provide neuropsychological support for the distinction between conscious and unconscious memory processes. Moreover, the results show the importance of studying cognitively homogenous MS groups as opposed to heterogeneous ones, in order to find the underlying mechanisms of memory deficits in MS. Interestingly, the neural systems needed for the unconscious use of memory do not seem to deteriorate even in MS patients with deficient overall cognitive capacity. This finding encourages the development of future rehabilitation programs, suggesting that unconscious remembering might help MS patients with deficient conscious memory to cope with their daily activities. Initial descriptions of sensory sensitivity [6] about attention deficit in patients with schizophrenia/including some personal reports/ that describe the noises loudness/ color brightness/ distraction and disorganization in patient. Sensory gate insufficiency/ that is measured by pre-trauma and latent inhibition such as techniques/also denotes the inability to filter out irrelevant information in this disorder. But Brown & et.al [6] in their studies didn't find any meaningful differences between patients with schizophrenia/patients with bipolar disorders and normal people/ in view point of sensory sensitivity. But the avoidance of feelings in people with schizophrenia and bipolar disorder was higher than normal. The schizophrenic patients frequently fail to respond and ascribe meaning to stimuli. Their performance in reaction time tasks is an example of slowed response in schizophrenia. Return responses (the urge to go back to previous responses) can also be another example of low sensory registration in patients with schizophrenia. In connection with sense searching Brown & et.al [6] concluded that schizophrenia and bipolar disorder groups were significantly obtained lower scores in sense search. According to the results/since the extreme sensitivity and inhibition to sensory stimuli and also impairment in social skill which is the result of sensory processing disorder/is a very important aspect of schizophrenia and partly to major depressive disorder, therefore, identifying the style of sensory processing in patients with these disorders/ can help to precise identify of impairment. Rotenberg [13] in

a study on patients with schizophrenia showed that/ cognitive impairment and inability to make appropriate use of past information/are connected with perceptual input or information processing and formation of signs that need to the left hemisphere activity.it is consider that/ patients with schizophrenia may have imperfect and impaired performance of the brain cortex/ and show heterogeneous defects in some of spatial and verbal short –time memory tests. Many researchers know the dysfunctions exist in attention and short-time memory processing as most crucial characteristic of schizophrenic disorder. Studies also showed that/patients with schizophrenia/ recall lower figures in immediate recollection and repetition (when more than two minutes) and act weaker than normal people in tracing tasks [13]. [14]/ write that Several studies have shown that the style of repressive character , negative emotions , inability to talk about feeling/ over assimilation and hysteric characteristics with a weaker immune system and emotions expression and thoughts depended on excitement/ are related to immune system performance improvement. Neuropsychological pattern that typically has been seen in patients with multiple sclerosis (MS) / includes memory impairment, failure to maintain attention, visual-spatial perception abnormalities, and low information processing and executive deficits [15]. In a study by [16]/ under the title of«Sensory symptoms of multiple sclerosis: a hidden reservoir of morbidity/the following results reports: Sensory symptoms were more common in MS patients than in controls, and differed in severity and quality. There was however a strong correlation between the total number of sensory symptoms reported and the presence of disability in the MS patients. Conclusions: Sensory symptoms are common in MS patients. Pain syndromes, transient neurologic events, Lhermitte's phenomenon, fatigue, respiratory symptoms and vertigo were present significantly more frequently in patients with MS than in a control population and contributed to subjective morbidity. Future clinical trials assessing therapy in MS might include sensory symptoms as secondary endpoints to capture this `hidden reservoir' of disease morbidity.

The purpose of this study was to assess, conscious, unconscious memory and sensory processing in patients with schizophrenia, multiple sclerosis, and those with Alzheimer's and comparing them with one another.

Research hypotheses

Conscious memory in patients with schizophrenia and multiple sclerosis (ms) is different.
 Conscious memory in patients with schizophrenia and Alzheimer's is different.
 Conscious memory in patients with multiple sclerosis (MS) and Alzheimer's is different.
 Unconscious memory in patients with schizophrenia and multiple sclerosis (ms) is different.
 Unconscious memory in patients with schizophrenia and Alzheimer's is different.
 Unconscious Memory in Patients with Multiple Sclerosis (MS) and Alzheimer's is different.
 Sensory processing in patients with schizophrenia and multiple sclerosis (ms) is different.
 Sensory processing in patients with schizophrenia and Alzheimer's is different.
 Sensory processing in patients with multiple sclerosis (MS) and Alzheimer's is different.

MATERIALS AND METHODS

In this study, three groups of patients with schizophrenia and multiple sclerosis and Alzheimer's disease per group of 15 people (N1 = N2 = N3 = 15) were selected. Our research method was causal-comparative. Statistical population were patients with schizophrenia in Mirzakochak mental hospital and patients with multiple sclerosis and Alzheimer's disease that are kept by formal caregivers in welfare centers or by informal caregivers in families in Rasht city of Guilan province in Iran.45 persons with MS, Alzheimer's disease and schizophrenia (in each group 15 persons) were randomly selected by accessible sampling method in 2014. then, subjects were asked to response to Wechsler Memory Scale to assess Conscious memory and Stroop test for assess of Unconscious memory and sensory profile questionnaires to measure of Sensory processing . Wechsler scale reliability coefficient for the subscales are in the range of 0/74 to 0/93 and its validity in a variety of clinical populations is 0/98 [17]. Reliability for first and second Stroop test cards has reported 0/88 and for third and fourth cards has reported 0/80 [4]. Coefficient of internal consistency of subscales of sensory processing test were reported between 0/60 to 0/78 and cronbach's Alpha coefficient of this test for total scale is 0/87 and for subscales of low registration, sense searching, sensory sensitivity and sense avoiding are as 0/72, 0/65, 0/75 and 0/71[6]. Then raw data were analyzed by multiple analyses of variance with using of spss16 software. Conscious and unconscious memory and sensory processing are considered for three groups as the dependent variables and the diseases as attribute independent variables.

RESULTS

As can be seen in [Table 1], in the survey of solution's effect on healthy mice, weight of liver and spleen in each test group was examined and in the first and third group, 9 mice and in the second group, 8 mice were survived at the end of test time.

Table 1: Descriptive information about the conscious memory

Depended variable	Subject groups	Frequency	mean	Std. Deviation	%95 confidence interval	
					Lower bound	Upper bound
Conscious memory	Schizophrenia	15	32/73	12/70	28/25	37/21
	Multiple sclerosis	15	28/60	5/90	24/12	33/07
	Alzheimer's disease	15	26/40	5/03	21/92	30/87
Time in third card	Schizophrenia	15	20/13	3/46	11/28	29/01
	Multiple sclerosis	15	24/28	19/98	15/41	33/14
	Alzheimer's disease	15	14/38	21/38	5/51	23/24
Time in fourth card	Schizophrenia	15	52/52	10/98	42/46	62/57
	Multiple sclerosis	15	55/05	22/11	45	65/10
	Alzheimer's disease	15	74/93	22/51	64/87	84/98

In survey of effects on healthy mice group with plant extract solvent gavage, results of [Table 2] was seen as below and seen that these mice group, were gavaged for only seven days with plant extract solvent to survey, effect of toxicity of solvent. This group has 27.7 average weight which at the end of seventh day reduce to 25.9. This group was with 9 alive mice at the end of seventh day and the below table conclude weight of spleen and liver of this group at the end of this test. As you can see at chart 1, with respect to no special toxicity was observed at examination test of toxicity in different groups, high dose with 100 mg/ml was selected for patient treatment.

Table 2: Average of time in the unconscious tests cards

Depended variable	Subject groups	Frequency	mean	Std. Deviation	%95 confidence interval	
					Lower bound	Upper bound
Time in first card	Schizophrenia	15	18/73	3/54	7/27	30/19
	Multiple sclerosis	15	20/41	17/81	8/95	31/86
	Alzheimer's disease	15	22	33/48	10/54	33/46
Time in second card	Schizophrenia	15	29/85	11/97	22/25	37/45
	Multiple sclerosis	15	38/22	21/51	30/61	45/81
	Alzheimer's disease	15	54/78	5/66	47/18	62/38

Table 3: Descriptive information about the components of sensory processing

variables	Disease groups	frequency	mean	Std. Deviation	%95 confidence interval	
					Lower bound	Upper bound
Total	schizophrenia	15	37	1/83	33/30	40/69

sensory processing	Multiple sclerosis	15	37/40	1/83	33/70	41/09
	Alzheimer	15	48/80	1/83	45/10	52/49

Table 4: Results of the multivariate analysis of variance in conscious and unconscious memory

source	Depended variable	Sum squares of three groups	Degrees of freedom	Squares mean	F	sig	Partial Eta Squared
Groups	Conscious memory	310/178	2and42	155/089	2/10	0/135	0/091
	time of third cart	742/173	2 and42	371/087	1/282	0/288	0/058
	time of forth cart	4518/654	2 and42	2259/327	6/071	0/005*	0/224
groups	Time of first cart	80/216	2 and42	40/108	0/083	0/921	0/004
	Time of second cart	4827/311	2 and42	2413/655	11/346	0/000*	0/351

Information of [Table 4]. in the fourth row, about time of the fourth card, according to a significance level of $p=0/005<0/01$, so the difference is significant.

•In the sixth row about time of the second card, given the significant level $p=0/001<0/01$, so the difference is significant.

Table 5: Results of the multivariate analysis of sensory processing

source	Depended variable	Sum squares	Degrees of freedom(d.f)	Squares mean	F	sig	Partial Eta Squared
groups	Sensory processing	1346/8	2 and 42	673/4	13/379	0/000*	0/389

The result of [Table 5].

Given that significant level equal to $p=0/001<0/01$.so there is a significant difference between the groups in sensory processing.

DISCUSSION

The results showed that there were significant differences between conscious memories, unconscious memories and sensory processing. A preliminary conclusion is that the conscious memories in patients with schizophrenia are less damaged. According to the presentation, researches conducted by other researchers suggest that conscious memories are damaged in three examined groups of patients. But present research has shown that the amounts of damages in Alzheimer's patients are more than the other tow groups (schizophrenia and multiple sclerosis).The amount of damage in the schizophrenic group is lower than the other two groups (MS and Alzheimer's).This may be due to the destruction of more parts of the brains of patients with Alzheimer's disease that is caused by the disease. This conclusion is consistent with findings by researchers such as [7], [8] and [13] cited in the literature of this study.

The average times are different in this study in the first and second card (unconscious) in three groups of patients with schizophrenia and patients with multiple sclerosis and Alzheimer's patients. An obvious conclusion is that the time required meeting the test cards. Patient with multiple sclerosis is better than the patient with Alzheimer's disease. Generally, in terms of unconscious memory patients with schizophrenia are significantly better than the other two groups. Patients with multiple sclerosis in terms of

the time mean were better than the group with Alzheimer's disease. The concluding is consistent with findings of [11] , which has cited in literature.

Average sensory processing is different in three groups of patients with schizophrenia, multiple sclerosis and patients with Alzheimer. An obvious conclusion is that the memory of sensory processing in patients with multiple sclerosis and Alzheimer's are better than the group with schizophrenia. This issue is consistent with the inhibition reaction by patients with schizophrenia that cited by [6] in literature. Totally patients with Alzheimer's disease had significantly better performance in sensory processing. Patients with schizophrenia had lower performance than the other two groups.

One of the major limitations in sample size are illiterate or low literacy people which make it difficult to gather information and need to give sufficient information and required training to individuals to fill the questionnaires which are time consuming. In the present study variables such as gender, marital status, education, and the severity and duration of illness are not included.

CONCLUSION

Given that sensory processing in patients with Alzheimer was better than the other tow groups, therefore, it is better to use of sensory processing and its enhancement to treatment and rehabilitation of these people, it means that must be used of sensory processing to compensate other memories. Because sensory processing isn't in a desirable condition in patients with schizophrenia and multiple sclerosis (MS), so it is necessary that the people who are at high risk of developing the disease or the initial stages of the disease, must be acted to improve their sensory processing.

With regard to this fact that the conscious memory in patients with schizophrenia is less damaged in comparison with the other tow groups of patients with multiple sclerosis and Alzheimer disease. Therefore it is better that in rehabilitation of this group conscious memory be used in addition of use of unconscious memory.

Since the conscious memory in Alzheimer's patients is more damaged than in the other tow groups, namely individuals with schizophrenia and multiple sclerosis, So it is necessary to detect those who have a high risk of developing the disease, such as the elderly resolutions and those who are in the early stages of the disease, and to be improved their unconscious memory.

Since the unconscious memory in patients with schizophrenia is better than the other two groups namely people with multiple sclerosis and with Alzheimer disease therefore it is better in rehabilitation of these patients the unconscious memory to be used and reinforced in them for compensation of other memories.

Generally most of the results of researches that have described in the research literature indicated that unconscious memories in three groups of patients remained almost intact. Therefore, strengthening of this memory must be accepted as a principle for the rehabilitation of patients with schizophrenia and individuals with acquired multiple sclerosis and individuals with Alzheimer's disease.

CONFLICT OF INTEREST

None

ACKNOWLEDGEMENTS

None

FINANCIAL DISCLOSURE

None

REFERENCES

- [1] Yang, M.dsm-5: Schizophrenia, [internet], 2013.[updated 2013August28].Available from: <http://www.mariayang.org>
- [2] American National Multiple Sclerosis Society.[internet], [2014] What is MS, Share.net, MSAAs, Improving lives today!Available from: <http://mymsaa.org//about/ms/overview>. Accessed: April 16, 2015.
- [3] Khatoni M, Zahari S. [2010] Communication problems in elderly patients with Alzheimer's disease and primary caregivers, *Journal of elderly*, 5(17): 36-42.
- [4] Bashar poor S. [2007] study the speed of informatio8n processing due to automatic and controlled memory in comparison the individuals with major depression with normal subjects [Master's Thesis] , Ardabil city, university of Mohaghegh Ardabili.
- [5] Ghamari H, Bashar poor S, Narimani. [2007] Comparison of automatic and controlled information processing in patients with major depression and normal control, and the effect of antidepressant drugs on these variables, *psychological studies*, 1:17-35
- [6] Ghamari H, Bashar poor S. [2009] The study of sensory and semantic information processing in schizophrenia, major depressive disorder and normal individuals.*journal of clinical psychology*, 2(1): 17-25
- [7] Nebes RD, Martin DC, Horn L. [1984] Sparing of Semantic memory in Alzheimer's disease, *Journal of Abnormal Psychology*, 93(3): 321-330

- [8] Kopelman MD. [1986] The Memory Deficits in Alzheimer- Type Dementia” A Review.The Quarterly Journal of Experimental Psychology, Section A: Human Experimental Psychology, 38(4): 575-602
- [9] Pekkaonen E, Jousmaki V, Kononen M, Reinikainen K, Partanen J. [1994] Auditory Sensory Memory Impairment in Alzheimer’s disease: An event-related potential Study. Clinical Neuroscience and Neuron Pathology, 5(18): 2541-2544
- [10] VaiRamanatan A. [1994] Interactive difference in speech of people with Alzheimer’s disease.Study of speech of a patient with Alzheimer’s while is talking with two different audiences, [N. tabatabaei, Trans] , Farhang Magazine, 37(38): 229-276
- [11] Knight RG. [1997] Controlled and Automatic Memory Process in Alzheimer’s Disease Department of Psychology, University of Otago,Dunedin,New-Zealand,34 (3):427-435
- [12] Seinela A, Hamalainen P, Koivisto M, Ruutiainen J. [2000] Conscious and Unconscious Uses of Memory in Multiple Sclerosis.Journal of the Neurological Sciences, 198(1-2): 79-85
- [13] Bahmani N, Zandghashghaei K, Khosravi S. [2012] Comparing the effectiveness of three types of music on memory performance and Attention maintenance in patients with schizophrenia.tow monthly Southern Medical Journal.Institute of Medical -ment Persian Gulf,Bushehr University of Medical Sciences and Health Services, 7(4): 706-715
- [14] Mehrinejad SA, Hoseini Abad Shapoori M, KhosravaniShariati SZ. [2012] Comparison of personality characteristics of patients with multiple sclerosis (MS) and normal individuals.Psychological Studies, Faculty of educational sciences and psychology,Alzahra University, 8(4) : 95-105
- [15] Saeidi MT, Ghorashi Rad. [2013] Clock Drawing Test: Screening of cognitive disorders in patients with MS, Journal of Isfahan Medical School,31(268): 2216-2227
- [16] Grant ADR, Eckert NJ, Bartz S, Reed JF. [2013] Sensory Symptoms of multiple sclerosis: a hidden reservoir of morbidity. Clinical Neurology, 5 (3): 83-179
- [17] Marnat GG. [2003] Handbook of psychological assessment. [Pasha Sharifi H, Nikkho M R.trans] ,Theran: Sokhan publition; 2014