Original Article

Utility of Bender-Gestalt test in differential diagnosis of brain damaged patients and normal subjects in Iranian population

Zahra Tajali[1], Changiz Rahimi[2*], Hossein Ali Khalili[3], Norolah Mohamadi[2]

[1] MA. in Clinical Psychology, Shiraz University, Department of Clinical Psychology, Shiraz, Iran, [2] Ph D. in Clinical Psychology, Professor, Shiraz University, Department of Clinical Psychology, Shiraz, Iran, [3] MD. Associate Professor of Neurosurgery, Trauma Research Center, Shahid Rajaee (Emtiaz) Trauma Hospital, Department of Neurosurgery, Shiraz University of Medical Sciences, Shiraz, Iran.

Correspondence: Changiz Rahimi, Professor, Dept. of Clinical Psychology, Faculty of Education and Psychology, University of Shiraz, Shiraz, Iran, Email: crahomi2016@hotmail.com.

ABSTRACT

Introduction: Using neuropsychological tests in differential diagnosis of disorders caused by brain damage and brain functions of normal subjects has always been attractive for experts of this field of science. The aim of this was to study the ability of the Bender-Gestalt Test in differential diagnosis of patients with brain damage and normal subjects in Iranian population. Methods and Materials: The research statistical population included all accidental and cerebral vascular accident patients who were referred to Shahid Rajai and Namazi Hospitals in Shiraz. The sample group of this study consisted of 12 patients with brain trauma and cerebral vascular accident patients, and 12 normal subjects who were selected by purposive sampling method. The groups of brain trauma and cerebral vascular accident and the normal subjects were matched for age and education. The patients with brain trauma and cerebral vascular accident were diagnosed by CT-Scan and then Bender-Gestalt Test was applied on them. At the end, the results were analyzed by independent t-test. Findings: There was a significant difference in the results of the Bender-Gestalt Test between the two groups of brain damaged patients and the normal subjects. Also, the most substantial type of errors between these two groups was preservation. After that, the highest degree of distinction between two groups was angulation difficulty and confused sequence of shapes, respectively. Conclusion: Based on this study, it can be concluded that the Bender-Gestalt Test can be used as a differential diagnosis test of brain lesions in order to prevent the unnecessary tomography of brain in Iranian population.

Keywords: Bender-Gestalt test, Brain lesion, Cerebral Vascular accident.

Introduction

Bender-Gestalt Test (BGT) is one of the widely used neuropsychological tests and it is an instrument for assessing visual-motor coordination which can be used both for children and adults. This test was designed in Medical Center of New York University and Bellevue Psychiatric Hospital by Loretta Bender in 1938 [1]. This test consists of 9 cards with geometrical images and was adapted from a set of 30 formations developed by Wertheimer, who used them to illustrate Gestalt laws of perception [2]. Standard cards of this test were published by "the American Academy of Child and Adolescent Psychiatry" (AACAP) [3]. This test was applied on adults with organic disease of brain, mental retardation, aphasia, psychosis, neuroticism and malingering by Bender [4].

Wertheimer emphasized on ability of normal subjects in responding to the designs in an integrated and interconnected way. Bender showed how individual performance level is affected by delays in perceptual-motor development, as well as pathological lesions or functional disorders. In fact, the majority of patients with brain disorders are unable to analyze complex stimulate sets or transform perceptions into proper movements. Proper test indicates relatively high percentage of functional disorders in visual-analytical, visual-spatial and visual-structural assignments in patients with brain damage, especially those with right hemisphere damage [1]. BGT is designed basically as a tool for diagnosis of brain damage and probably it is mostly used as a screening instrument for diagnosis of adults' organic diseases [1, 2].

BGT is often introduced as a tool for screening brain pathology. Nevertheless, this test gave no in-depth information about specific and various details of damages. Actually, the test has limitations in diagnosis of severe brain damage especially in

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right hemisphere of cerebrospinal reign [4]. Koppitz (1938) [5] declared the application of the BGT in diagnosis of brain disorder, and in the last fifty years many scholars with their extensive researches approved the utility of this test in diagnosis of brain disorders [6]. Researches of Tahmasebi and et al. (2001) indicated that patients with brain trauma and normal subjects had different performance in the BGT [7].

Since the beginning, the BGT has been subject to objective scoring in various systems; although Bender herself considered clinical impressions in this test important, but scholars have tried to set objective criteria in some way in order to achieve a common language and minimize effects of individual impressions. These criteria are based on empirical findings. Pascal-Satel scoring method is one of the most famous and oldest scoring methods. In this method, each design (except design A) is scored in terms of 10 types of errors (out of 13 errors), including asymmetry in designs, putting dot and dash instead of circle or circle instead of dot, rotation, distortion, line extension, omission, angulation difficulty, and line quality. Total score (total errors) are converted to Z score (range from 32 to 201). The standard Z score, as a cut-off point in organic disease of brain, is 100. Accuracy of this test in different researches varied from 63 to 88% (with average of 74%). This method of scoring is time consuming and difficult [8].

Another scoring method is by Hein [9] in which 15 types of signs or errors are scored by coefficient from 1 to 4. Total scores are in a range from 0 to 34. Cut-off point is 9 or more. Accuracy range of diagnosis is between 55 to 86%, with an average of 70%.

In Hutt-Briskin method [4] 12 types of errors are scored. This method has been revised several times and Hutt published his final system in 1977, in which errors such as closure, simplicity and fragmentation were considered as indicators [10]. Score of 5 or higher is a sign of organic disease of brain, and minimum and maximum scores are from 0 to 12. Subsequently, Lacks investigated its experimental validation by applying this test on different groups of patients. Accuracy range of diagnosis of Lacks system is between 64 to 86%, with an average of 77%.

In Paucker-Quick scoring method (1976), scoring each protocol takes about 1 minute. In this method, each design gets a score from 0 to 4, based on its degree of deviation from its original form and status. Therefore, total scores will be between 0 and 63. Cut-off point is not mentioned in this system.

The Marley scoring method is relatively simple and interesting. Great importance is given to errors such as perseveration, rotation, omission, and retrogression in this method of scoring (higher error score is given to them). For running and scoring test errors, regular education and organization is necessary. As well as, having extensive and distinct theoretical information in terms of psychosis and psychometric and attending general principles for implementation and observation the subject's behavior is important. At least three individuals should score independently and consistency of these three scores should be surveyed. If the consistency is law, individuals' perception about scoring and their criteria should be discussed exactly and cleared dispute points in order to reaching an objective criterion [8].

Regarding to increasing attention of psychologists to this point, that the test can be used in diagnosis of organic brain syndromes, and meanwhile the incompatibility of different research results lead to this point that more studies should be done and the obtained results should be analyzed exactly. The results of this study can probably help us to know whether BGT can be used as a precious and proper diagnostic instrument and a screening tool for brain lesions diagnosis in psychological and psychiatric clinics in order to avoiding unnecessary tomography of brain. The purpose of this study was to study the utility of the Bender-Gestalt test in differential diagnosis of brain damaged patients and normal subjects using the Marley scoring method in Iranian population.

Methods

The method of this study was casual-comparative. The results of this test are compared in two groups including brain damaged patients and normal subjects.

The research population included all patients with brain damage and cerebral vascular accident who were referred to Shahid Rajaei and Namazi Hospitals in Shiraz from September 2016 until February 2018 in iran. For this research, brain lesions of patients with brain damage and cerebral vascular accident were diagnosed by CT-scan and screened by the following control variables: age range of 15 to 55 years, no visual impairment, no sensory-motor impairment in hands, desire to participate in the research, no mental illness background and admission at psychiatric hospitals. Diagnosis of brain lesions were evaluated by CT-scan and interpreted and approved by the relevant specialists. After brain damage diagnosis using CT-scan, clinical interview was conducted and then the BGT was administered. Normal subjects were chosen from staffs of Shahid Rajaei and Namazi Hospitals who were matched for their age and education with patients.

Measures

The Bender-Gestalt Test (BGT): BGT includes 9 cards with geometrical images with a size of 4 x 6 inches, and there is one image on each card. These cards were presented to the subjects one by one and they were asked to draw each image on a white sheet with 11 x 8.5 inches (A4) with a pencil. The recreated images were evaluated based on reconstructed shapes, relevance of images together and total spatial background.

The procedure was done individually. During the test, each card was shown to the subject one by one and the test started with the following verbal guide recommended as a standard method by Hutt: "I want to show you these cards one by one. There is one simple design on each card. I want you draw these designs as well as you can on the sheet. Do it any way you want to do. This is not a painting ability test but try to draw them as well as you can. Work at any speed you want." First, put card A on top of the subject's sheet while the letter A is at the bottom of the card. Similarly, other cards are presented. When the subject finished one design, the other is presented. When

he/she is completing, no additional comment or tip is provided. If he/she makes any specific questions, no explicit answer should be given to them. For example, "Draw it like the image as much as possible."

There is no time limitation on this test, but the exact beginning and finishing time for each image should be recorded. It is said to the subject he/she cannot rotate the cards or sheet but he/she can adjust the angle of the sheet according to his/her habit as vertical sheet mode remains. During the test, the examiner should attend to all practical and verbal behavior of subjects and write them down on the behavioral checklist. The manner of drawing every 9 cards is evaluated for scoring. In the Marley scoring method is 12 specific criteria which are introduced for differential diagnosis of brain organic pathology in a hierarchical manner. The criteria include: confused sequence, interference, superimposition of design, work over, line quality, angulation difficulty, perseveration, contamination, rotation, omission and retrogression [8].

Procedures

All patients were tested individually after doing CT-scan and approving their brain damage by expert physicians at Shahid Rajaei and Namazi Hospitals. A written commitment was made by the participants in relation to their voluntary participation in the test. The participants were allowed to leave the test whenever they wanted. Finally, results of the BGT were scored using the Marley scoring method by experienced clinical psychologist.

Statistical Method

Data gathered by SPSS statistical software were analyzed using descriptive statistic methods and independent t-test.

Results

Table 1 shows means and standard deviations of scores of the two examined groups in the total score of the descriptive statistic methods. As it can be considered, brain damaged patients obtained higher scores than normal subjects. Comparison of the two groups in table 1 using independent t-test indicated a significant difference between them. Brain damaged patients significantly obtained lower scores than normal subjects. Diagram 1 shows the comparison of two groups mean.

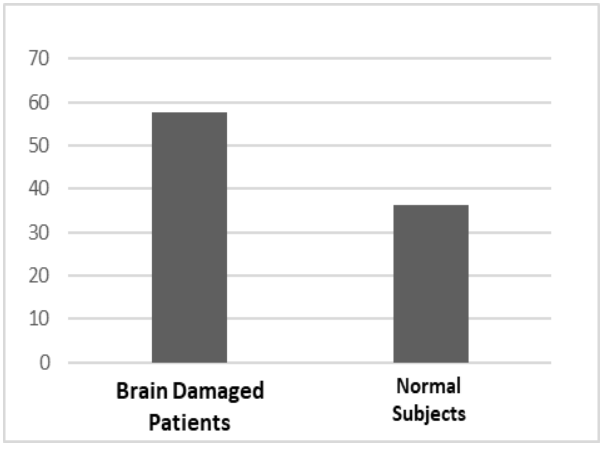

Diagram 1: Comparing means and standard deviations of the Bender-Gestalt test scores in brain damaged patients and normal subjects

Table 1: Comparison of the Bender-Gestalt Test scores of brain damaged patients and normal subjects

Leven Test	Groups	M±SD	N	Min	Max
F=0.24	Brain Damaged	57.75 ±20.84	12	20	95
P= 0.63	Normal Subjects	36.25 ±23.91	12	0	85
Independent t-test			t= 2.35	P< 0.03	

Means and standard deviations of scores of brain damaged patients and normal subjects in different criteria of the BGT, and also a comparison between two groups by independent t-test have been reported in table 2.

As shown in table 2, the highest average errors for normal subjects were in retrogression, line extension, work-over, rotation, omission, angulation difficulty, perseveration, contamination and confused sequence, respectively and there were no errors in interference, superimposition of designs, and line quality. Also, the highest average errors for brain damaged patients were in retrogression, omission, line extension, perseveration, work-over, angulation difficulty, confused sequence, interference, line quality and rotation, respectively and there were no errors in contamination and superimposition of designs.

Table 2: Criteria for scoring the Bender-Gestalt test based on the Marley scoring system for brain damaged patients and normal subjects

Scoring Criteria	Brain Damaged M (SD)	Normal Subjects M (SD)	df	t	P
Confused Sequence	1 (1.47)	0.08 (0.28)	2 2	2.11	**0.04**
Interference	0.5 (1.16)	0.0 (0.0)	2 2	1.48	0.15
Superimposition of Designs	0.0 (0.0)	0.0 (0.0)			
Work over	4.16 (2.88)	4.16 (2.88)	2 2	0.00	1.0
Line Quality	0.5 (1.73)	0.0 (0.0)	2 2	1.0	0.32
Angulation Difficulty	4.08 (3.60)	1.16 (2.72)	2 2	2.23	**0.03**
Perseveration	7.50 (4.52)	0.83 (2.88)	2 2	4.30	**0.001**
Line Extension	8.33 (3.89)	5.83 (5.14)	2 2	1.34	0.19
Contamination	0.0 (0.0)	0.83 (2.88)	2 2	-1.0	0.32

According to the results of table 2, there was a significant difference between the scores of brain damaged patients and

normal subjects in order to confused sequence (P<0.04). There was a significant difference between the scores of brain damaged patients and normal subjects in order to angulation difficulty (P<0.03). Also, there was a significant difference between the scores of brain damaged patients and normal subjects in order to perseveration (P<0.001). Perseveration error had the most differentiating power between the two groups of subjects. After that, angulation difficulty and confused sequence errors had the most significant difference.

Discussion

Findings of this study indicated that brain damaged patients significantly had weaker performance than normal subjects in the Bender-Gestalt test. It means that patients with brain damage had weaker performance than normal subjects in visual perception and transcription of the BGT. Tirgari (1997) in his research with the title of standardization of the BGT in performance of adult subjects, and Bender research in 1983 concluded that the BGT has the ability to diagnose the brain lesions. Also, Storendt (1982) examined the performance of the BGT in diagnosis of Alzheimer type of dementia. Results showed that the BGT had no ability in diagnosis of very weak and weak dementias from normal elderly people, but it was capable to diagnose moderate and severe dementias.

Tsai and Tsungang (1981) tried to determine the brain damage of psychiatric patients using different methods including neurological examination and mental status examination on 135 psychiatric patients [11]. They reported that BGT, electroencephalography (EEG) and neurologic examination showed the lesion, as well. Koppitz (1938) declared the utility of BGT in diagnosis of brain dysfunctions, and in the last fifty years many researchers by their extensive researches approved the utility of this test on diagnosis of brain disorders. These studies indicated that in this test patients with brain damage had more immature and primitive performance than normal subjects [6].

Due to efficiency of the BGT in screening brain lesions, it can be used as a tool for screening brain lesions and avoiding unnecessary paraclinical tomography. Since this test was applied on patients with mild brain trauma and cerebral vascular accident and impossibility of collaboration of patients with moderate and severe brain damage due to admission in the Intensive Care Unit (ICU), these results should be generalized with caution. Considering that the sampling method was purposive, so generalization on these results should be done with caution. There are some suggestions for future studies including, studying and comparing tests in patients with brain tumor, in order to surveying the performance of patients with brain tumor in these tests; studying and comparing tests in patients with brain lesions in each lobe; studying the performance of accidental patients with moderate and severe brain damage; researching on larger samples; and researching with sex differentiation of patients and comparing both genders performance.

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