

Clock Drawing Test in Hospitalized Substance Abusers

Elham Foroozandeh*

Department of Psychology, Naein Branch, Islamic Azad University, Naein, Iran

***Corresponding Author:** Elham Foroozandeh, Ph.D. in Psychology, Department of Psychology, Naein Branch, Islamic Azad University, Naein, Iran.

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Abstract

The clock drawing test is essentially a test in the field of neuropsychology and is widely used due to rapid implementation and easy scoring. The aim of this study was determine the details of functions of hospitalized substance abusers in clock drawing test. The subjects were randomly selected among male substance abusers ($n = 25$) and clock drawing test individually performed in two stages. The first stage was conducted without the guidance of the examiner and the second phase performed after guidance. To compare the errors of clock drawing test in stage 1 and stage 2, ANOVA was calculated and the differences between two stages approved statistically significant ($F_{1,27} = 9.75, P < 0.004$). The findings were discussed according the cognitive processes especially working memory, attention and probably personality traits involve with clock drawing test in hospitalized substance abusers.

Keywords: Clock drawing test; Substance Abuse; Executive function

Abbreviation: CDT: Clock Drawing Test

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Introduction

The clock drawing test (CDT) is essentially a test in the field of neuropsychology and is widely used due to rapid implementation and easy scoring. Considering that this test is a visual-spatial task, it is used to evaluate the quality of the functions of parietal lobe of right hemisphere of brain, as well as the structural and executive functions in frontal lobe. This test has been used to evaluate Alzheimer's disease, Parkinson's disease, schizophrenia, and other organic brain disorders [1-5]. CDT is a good task to access the cognitive functions and can be used in a range of other disorders that are related to brain functions like substance abuse disorders, multiple sclerosis, learning disorders etc.

To complete this test, the participant needs to understand the verbal instructions, memorize them and perform according the coded instruction in a good-constructive mental pattern. The previous studies show that the test results are influenced by demographic and personal factors like age, education and mood. Better performing in CDT can be seen in subjects with higher education level, not-older subjects and subjects with normal mood, not depressed.

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Persons with substance abuse show different degrees of neuroscience damages. Chronic abuse have adverse effects on various cognitive processes, especially attention, memory, and executive functions. Cognitive deficits are recognized as one of the most important aspects of substance abuse disorders. These deficits seem to affect all substance abusers in varying degrees, and the outcome of treatments in this group of patients is due to the cognitive deficits and brain dysfunctions. The cognitive impairments are discussed in various areas such as memory, problem solving, selective attention, judgment, attention, executive functions, and other aspects [6-9].

Terrett., *et al.* [6] reported that Long-term opiate users were significantly impaired on prospective memory performance compared with controls. In another study, Ketamine poly-drug users were assessed by Rey-Osterrieth Complex Figure to evaluate the visual memory and delayed recall. The results of this study displayed predominantly visual memory impairments in Ketamine poly-drug users [7]. Also Marijuana-using adolescents and controls show significantly differences in short-term recall memory evaluated by Brown-Peterson Memory Test [8].

According to these findings it can be suggested that the functions of brain lobes, especially frontal lobe show impairments in substance abusers so the aim of this study was determine the details of functions of substance abusers in CDT. The aim of this study was determine the details of functions of hospitalized substance abusers in clock drawing test.

Materials and Methods

Subjects

The subjects of this study were randomly selected among male substance abusers (n = 25) from Modares psychiatry hospital, Isfahan, Iran. The range of age of patients was between 20 to 30 years old and their education was diploma. The sample of this study was selected from patients who 1. Had enough attention to understand the instruction of CDT and 2. Did not suffer from visual or motor disabilities.

Method

The instruction of test was given to the participant individually. This method was used in [10]. CDT individually performed in two stages. The first stage was conducted without the guidance of the examiner and the second phase under the guidance. In the first phase a sheet was placed in front of the participant on the table and he was told that draw a clock on this paper with its numbers that show 10 after 11, draw the clock completely clear and legible.

There was no guidance after starting the test. In second phase the patient was told "Now in this circle I draw a clock which shows 11:10. You see drawing and then draw this clock again". Then the examiner drew 12, 6, 3 and 9 and the other number from 1 to 11 finally the hour and minute hands were drawn. Both hands were shown as arrows. After completing this stage, the participant was asked to draw the same clock again. Using a chronometer the time was spent for first and second phases was assessed. Scoring the tests was done according Table 1.

Statistical Techniques

After gathering data, the errors of substance abusers in the two stages of CDT were analyzed by SPSS 16. To comparison the stages, one way analysis of variance (ANOVA) was used and the errors of drawings was compared in stage 1 and stage 2.

| Items | Score | Stage | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|---|
| | | 1 | 2 |
| The shape is similar to the clock | 1 | | |
| There is external environment (drawing a line as environment of clock) | 1 | | |
| Diameter of 1 inch (2.54 cm) | 1 | | |
| All numbers are within the circle | 1 | | |
| The first numbers' insertion is 12,6,3,9 | 1 | | |
| Number insertion is correct (symmetry on both sides of the axis of 6-12)- if yes, the next item will not be scored | 2 | | |
| If there is mistakes in number insertion, he/she is corrected them or omitted the errors | 1 | | |
| The numbers are written in English (or in Persian- not mixed) | 1 | | |
| The sequence from 1 to 12 is correct. There is not added or omitted numbers | 1 | | |
| There are 2 hands (minute hand and hour hand) | 1 | | |
| Both hands are shown as arrows | 1 | | |
| Hour hand is between 11 and 12 | 1 | | |
| Minute hand is longer than hour hand | 1 | | |
| None of the following items | | | |
| None of the following items <ul style="list-style-type: none"> • the hand shows 4 or 5 • it is written 11:10 digitally • or wrist watch there is not a graph of hand • There is letters or words • There is exceed from the circle | | | |
| Total | 15 | | |

Table 1: Scoring of CDT.

Results and Discussion

According to table 2, the mean age of participants in 20-25 years old was 23.7 ± 1.55 , and the mean age in the second category (26-31 years old) was 28.02 ± 1.38 . In stage 1, mean errors of drawings was 7.60 and it is 2.00 in the second stage of clock drawing (see Table 3).

| Age | Frequency | % | Mean | SD |
|-------|-----------|-----|-------|------|
| 20-25 | 7 | 28% | 23.7 | 1.55 |
| 26-31 | 18 | 72% | 28.02 | 1.38 |

Table 2: Descriptive statistics of age in participants.

| | N | Mean | | Std. Deviation |
|---------|----|-----------|------------|----------------|
| | | Statistic | Std. Error | |
| Stage 1 | 15 | 7.60 | 3.628 | 14.050 |
| Stage 2 | 15 | 2.00 | .976 | 3.780 |

Table 3: Descriptive Statistics of “errors” in stage 1 and stage 2.

The Frequencies of “errors” in stage 1 and stage 2 (n = 25) in each item are shown in table 4. According this table, the most frequencies errors are related to these items:

1. The numbers are written in English (or in Persian- not mixed): frequency in the first stage = 12 (21%).
2. Number insertion is correct (symmetry on both sides of the axis of 6-12): frequency in the first stage = 8 (14%).
3. All numbers are within the circle: frequency in the first stage = 7 (12%).

| Items | Stage | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----|
| | 1 | 2 |
| The shape is similar to the clock | 2 | 0 |
| There is external environment (drawing a line as environment of clock) | 2 | 0 |
| Diameter of 1 inch (2.54 cm) | 4 | 1 |
| All numbers are within the circle | 7 | 2 |
| The first numbers' insertion is 12, 6, 3, 9 | 6 | 1 |
| Number insertion is correct (symmetry on both sides of the axis of 6-12)- if yes, the next item will not be scored | 8 | 2 |
| If there is mistakes in number insertion, he/she is corrected them or omitted the errors | 0 | 0 |
| The numbers are written in English (or in Persian- not mixed) | 12 | 4 |
| The sequence from 1 to 12 is correct. There is not added or omitted numbers | 2 | 0 |
| There are 2 hands (minute hand and hour hand) | 2 | 1 |
| Both hands are shown as arrows | 6 | 2 |
| Hour hand is between 11 and 12 | 2 | 0 |
| Minute hand is longer than hour hand | 0 | 0 |
| None of the following items <ul style="list-style-type: none"> • the hand shows 4 or 5 • it is written 11:10 digitally • or wrist watch there is not a graph of hand • There is letters or words • There is exceed from the circle | 4 | 2 |
| Total | 57 | 15 |

Table 4: Frequencies of “errors” in stage 1 and stage 2 (n = 25).

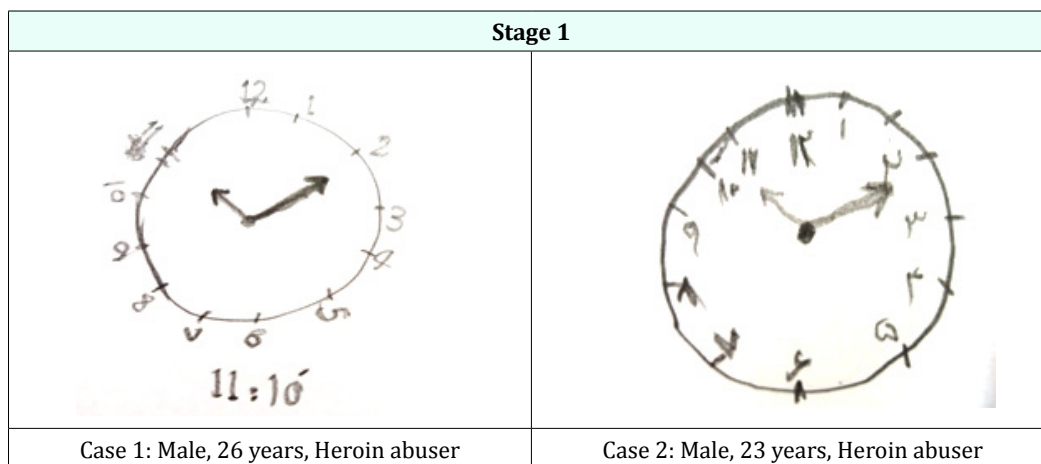
| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|----|-------------|-------|------|
| Between Groups | 63.000 | 1 | 63.000 | 9.758 | .004 |
| Within Groups | 167.857 | 26 | 6.456 | | |
| Total | 230.857 | 27 | | | |

Table 5: ANOVA for compare the errors in stage 1 and stage 2.

To compare the errors in stage 1 and stage 2 of clock drawing test, ANOVA was calculated and according table 5, the differences between two stages are statistically significant ($F_{1,27} = 9.75, P < 0.004$).

In pic.1 some of the CDTs are presented.

Pic. 1: samples of CDTs in heroin abusers



Conclusion

The results obtained from this study approved the differences between executive functions of substance abusers in the first and the second stages in CDT that shows cognitive impairments in the first stage which can be reduced after modeling and guidance in the second stage. Executive functions are defined as complex processes used to solve new problems. Effective functions are characterized by regulating behaviors to access the desired goals and using strategic comparison to achieve the goals.

This process requires person to be able to regulate behaviors in the proper direction and if this progress is not enough, person needs to change the plan for effective response. In addition, when a person reaches the target, he/she must end the actions, and ultimately, effective plans must be stored in long-term memory and be able to evaluate this process. According to the definitions of executive functions, it seems that hospitalized substance abusers suffer from impairments in working memory and attention. In the first stage of CDT they show dysfunctions in details of clock that are seen in errors related to written numbers, number insertion and location numbers.

These errors are probably related to details of clock which may approve attention deficits. In the previous studies the deficits in attention process of substance abusers have been suggested [11-13]. On the other hand, substance abusers may have some personality traits such as narcissism [14]. In Iranian substance abusers in this study that were educated diploma, writing the numbers in both Persian and English may show narcissistic trait while this is considered as an error in CDT. Writing numbers in two languages may be related to narcissistic tendency to show the knowledge, mental capacity and talent of hospitalized substance abusers and denying their problems that had them to stay in psychiatric hospital.

Also fewer errors in the second stage of CDT show that working memory plays a crucial role in the results of CDT in hospitalized substance abusers and after modeling, their functions significantly improve. One of the limitation of this study was few cases who participated in the study. A large number of substance abusers in Iran who are in drug treatment refer to private clinics and the others, who are referred to hospitals suffer from the other mental disorders like mood disorders and severe depression.

In sum it can be said that CDT as an easily performed test may use to evaluate the deficits in memory especially working memory, attention and probably personality traits in hospitalized substance abusers. In the future studies on substance abusers using CDT as a neuropsychological tool to evaluate the cognitive functions of frontal lobe with clinical assessment of memory and attention process is proposed. Such studies will determine the effect of substance abuse on cognitive functions in the different and especial domains like selective attention, executive functions and visual memory. Also the comparisons of effects of different substances on cognitive functions in hospitalized abusers may show the differences of damaged neuropsychological functions after chronic abuse periods.

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