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Evaluation of impulsivity and complex attention functions of subjects with substance use: Sample from Adiyaman province

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Abstract

The aim of this research is to compare impulsivity and complex attention functions in individuals with substance use disorders to those who do not use substance. Design of this study was a case-control study. Universe of this study was patients with substance use who admitted to psychiatry department of our hospital. Among them, 33 (94.3%) males and 2 females between 18-65 years of age formed the study sample. Randomly selected 23 (92.0%) males and 2 (8%) females without any substance use disorders who were similar to the study group according to age and sex formed the control group. A statistically significant difference was found between the two groups in terms of Barratt's total impulsivity score, motor impulsivity, and non-plan point scores ($p<0.05$). There were two statistically significant differences ($p<0.05$) between two groups in terms of Trail Making Part B, Trail Making Part B / Trail Making Part A, Trail Making Part B - Trail Making Part A, Trail Making Part B + Trail Making Part A. Subjects using substances have difficulties with concentration, delaying gratification, making appropriate decisions, and inhibiting responses. Another important finding of this study was higher levels of disturbance in complex attention function in subjects with substance use. According to this result, subjects with substance use have difficulties in changing between different stimulating sets, following consecutive stimuli and mental flexibility. Long term follow-up studies are needed to understand the reciprocal relations between substance use, impulsivity, and complex attention.

Keywords: Substance use disorder, impulsivity, complex attention

Introduction

Substance abuse has emerged as an important biopsychosocial problem since human beings have realized that certain substances change their own mood and feel different, even though they are not permanent [1]. Although the existence of a special personality for addiction is rejected, individuals with substance use disorders differ from controls in terms of some personality traits such as impulsivity and search for novelty. Dependents are often people whose internal tensions are too high and whose lives are not satisfactory to them [2].

Impulsivity includes a variety of behaviors that are overly risky, unsuitable for the environment, not well planned, immature and often resulting in undesirable consequences. Impulsivity is manifested by carelessness, impatience, searching for excitement, seeking pleasure, taking risks, low probability of harm, and extroversion. Impulsivity is also one of the core manifestations of many psychiatric disorders [3]. It is generally accepted that impulsive actions consist of three dimensions. First; not to use existing information to think about the consequences of behavior. Latter; not to give up a small bonus at that moment for a great prize to be earned later. The third is; cannot suppress established powerful motor reactions [4]. When these three dimensions are evaluated together, it can be said that the impulse disrupts the ability to assess a certain situation and respond flexibly to this situation [5].

In the literature, there are many studies that examined the relationship between impulsivity and substance use. A study of the relationship between cannabis use and alcohol abuse behavior and impulsivity level in university students revealed that the students who were exposed to cannabis and excessive drinking

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behaviors had a higher level of impulsivity and novelty seeking behavior [2,6]. Kollins [7] said individuals who had higher rates of impulsivity started smoking, drinking alcohol and using cannabis earlier. A study by Vonmoos et al. [8] found that recreational cocaine-using and dependent cocaine users were more impulsive and likely to seek excitement when compared to the control group. Even if the difference between the impulsivity levels of those who use and those who do not use the substance is revealed, this does not clarify the cause-effect relationship between substance use and impulsivity [9]. Three hypotheses have been proposed to explain the relationship between impulsivity and substance addiction. First, the high level of impulsivity has led to substance abuse and drug addiction. Second, substance use has increased the level of impulsivity. The third is that impulsivity and substance use are related to a third factor [10].

Attention is the conscious actuation of the psychological functions that occur with perception, thinking and imagination. Complex attention, which is a frontal executive function, consists of attention maintenance, concentration, persistence, exclusion of distracting stimuli, and inhibition of inappropriate response tendency [11]. In the study by Davies et al. [12], the duration of the Trail Making Test Part A (TMT-A) for substance abuse was found to be similar to that of the control group. In the same study, Trail Making Test Part B (TMT-B) duration was reported to be longer than control group. Konrad et al. [13] found that the duration of TMT-A and TMT-B of treated alcoholic dependents was longer than the control group. However, this difference was not found to be significant.

The prevalence of substance use disorders appears to have increased significantly over the years with various causes [1]. This has led to the need to conduct research on addiction and to identify a number of measures to prevent addiction. It is thought that our study will enhance the level of knowledge about the factors predisposing to substance use disorders and contribute to the development of treatment programs for the groups at risk.

Material and Methods

Study Design and Participants

Design of this study was a case-control study. Universe of this study was patients with substance use who admitted to psychiatry department of our hospital (between 01/03/2016 and 31/05/2016). The patient group included 33 (94.28%) males and 2 (5.72%) females between 18-65 years of age. There was no significant difference between the universe and the sample in terms of gender ($p = 0.369$). The mean age of the universe was 23,27±4,63 while the mean age of the sample was 24,51±5,34. There was no significant difference between the two groups ($p = 0.259$). The patients were not taking any medication. Patients who used substances in the last month were excluded from the study. Randomly selected 23 (92.0%) males and 2 (8%) females without any substance use disorders who were similar to the study group according to age and sex formed the control group. This study was approved by the Ethics Committee of Adiyaman University (Date: 23.03.2016, Protocol Number: 2016/2-6).

Assessment

Sociodemographic Form

A form containing sociodemographic and clinical information was filled in by the researcher. Age, gender, education level, marital status, job, number of hospitalizations, additional psychiatric diagnosis, history of forensic prosecution, attempt to quit substance, alcohol-substance type were used as variables in the questionnaire.

Trail Making Test

Trail Making Test (TMT), originally developed by psychologists studying in the United States Army, is a widely used neuropsychological tests worldwide. TMT which measures complex attention, working memory, planning and set change from executive functions requires motor skills and visual-spatial processing. TMT consists of two forms, A and B. In both forms, stimulant substances are scattered on the test form. In the first part, the subject combines the numbers in random order starting from 1 on the page. In the second part, both numbers and letters of the alphabet are scattered randomly on the paper, and the subject moves from 1 to A by drawing a number of letters from 2 to B. The TMT practice material, consisting of four pages of A4 size, contains exercise and test pages for each of the A and B forms. TMT Turkey normative study for 20-49 years of age, made by Turkes et al [14].

Barratt Impulsiveness Scale

It is a 4-point likert type measure consisting of 30 items and three sub-factors. Factors; motor impulsivity, non-planning, attention-related impulsivity. The Turkish validity and reliability study of the scale was performed by Gulec et al [15].

Statistical Analysis

Windows SPSS 21.0 program (Statistical Package for the Social Sciences Inc.) was used for statistical analysis. Mean, standard deviation, percent, and median were used as descriptive statistics. It was investigated by the Kolmogorov Smirnov test that the variables exhibited normal distribution ($p > 0.05$). Independent sample t test was used to compare the time to TMT-A, attention related impulsivity, Barratt impulsivity scale total score, and the time to TMT-B / TMT-A variables which exhibit normal distribution. Mann-Whitney U test was used to compare TMT-A error, TMT-A correction, TMT-B time, TMT-B error, TMT-B correction, TMT-A time + TMT-B time, TMT-B – TMT-A, motor impulsivity, and unintended impulsivity variables which not exhibit normal distribution. In comparing categorical variables, chi-square test was used. Statistical significance level was accepted as $p<0.05$ for all values.

Results

The identifier properties of the individuals are shown in Table 1. There were no significant differences in terms of age, gender, marital status, and working status ($p>0.05$). There was a significant difference in terms of education status. The education level of control group was higher than the control group ($p=0.005$). The mean age of the patient group was 17.2±4.17 years, the mean number of quitting substance use attempt was 4.62±4.52 times, and the mean duration without substance use was 112.37±137.77 days. Additional psychiatric diagnosis was present in 3 (8.6%) persons with substance use disorder and 32 (91.4%) had no additional psychiatric diagnosis. Twenty-two (62.9%) persons with substance use disorders had a history of criminal prosecution, while 13 (37.1%) had no criminal history. While 5 (14.3%) had

a history of hospitalization, 30 (85.7%) did not have a history of hospitalization. In terms of number of substance, 17 (48.6%) were using one substance, 17 (48.6%) were using two substances, and 1 (2.9%) were using four substances. The substances used by the group with substance use disorder, the duration of use, the first substance they used and the substances they preferred were shown on the table (Table 2).

The participants' values for the Barratt Impulsivity Scale were shown on the table (Table 3). A statistically significant difference was found between the two groups in terms of Barratt's total impulsivity score, motor impulsivity and non-planning scores ($p<0.05$).

The values of the participant's TMTs were shown on the table (Table 4). There were statistically significant differences ($p<0.05$) between two groups in terms of TMT-B time, TMT-B time / TMT-A time, TMT-B time - TMT-A time, TMT-B time + TMT-A time.

Table 1. Sociodemographic Data

	Patient n (%)	Control n (%)	p value
Male	33 (94.3)	23 (92.0)	0,726
Female	2 (5.7)	2 (8.0)	
Working status			
Yes	26 (74.3)	16 (64.0)	0,391
No	9 (25.7)	9 (36.0)	
Marital Status			
Married	8 (22.9)	6 (24.0)	0,918
Single	27 (27.1)	19 (76.0)	
	Mean±SD	**Mean±SD**	**p value**
Age	24,51 ± 5,34	23,44 ± 4,54	0,418
Education (Years)	9,97 ± 1,90	11,32 ± 1,57	0,005*

*p<0.05
Statistical Analysis: Chi-square
Note: SD: Standard deviation

Table 2. Substance Use Characteristics

Substance	n (%)	Duration of Substance Use (Mean±SD)	Preferred Substance n (%)	Preferred Substance n (%)
Synthetic Cannabinoid	3 (8.6)	28.00±6.92	1 (2.9)	3 (8.6)
Marijuana	26 (74.3)	45,69±30.63	24 (68.6)	11 (31.4)
Alcohol	6 (17.1)	60,50±58.18	4 (11.4)	3 (8.6)
Heroin	13 (37.1)	36,31±21.97	4 (11.4)	13 (37.1)
Volatiles	1 (2.9)	12.00±0.00	0 (0.0)	1 (2.9)
Ecstasy	6 (17.1)	44.00±27.01	2 (5.7)	4 (11.4)

*p<0.05
Statistical Analysis: Descriptive statistics (Mean, percentage, standard deviation)
Note: SD: Standard Deviation

Table 3. Barratt Impulsiveness Scale Results

	Patient (Mean±SD)	Control (Mean±SD)	p value
Motor Impulsiveness	13.34±2.63	11.96±1.94	0.030*
Do Not Plan	22.05±3.58	19.84±2.32	0.015*
Attention-related Impulsivity	30.97±8.13	27.60±6.46	0.091
Barratt Impulsivity Total Score	66.37±13.22	59.40±9.70	0.029*

*p<0.05
Statistical Analysis: Independent samples t test
Note: SD: Standard Deviation

Table 4. Trail Making Test A and Trail Making Test B

	Patient (Mean±SD)	Control (Mean±SD)	p value
TMT-A Time	40.91±14.26	37.04±10.74	0.254
TMT-A Error	0.11±0.32	0.08±0.27	0.665
TMT-A Correction	0.17±0.51	0.20±0.40	0.432
TMT-B Time	86.68±32.66	65.04±17.57	0.002*
TMT-B Error	0.85±0.73	0.56±0.65	0.115
TMT-B Correction	0.25±0.61	0.08±0.27	0.195
TMT-B Time / TMT-A Time	2.16±0.53	1.78±0.28	0.001*
TMT-B Time - TMT-A Time	45.77±25.28	28.00±10.26	0.001*
TMT-B Time + TMT-A Time	127.60±43.60	102.08±27.05	0.010*
Barratt Impulsivity Total Score	66.37±13.22	59.40±9.70	0.029*

*p<0.05
Statistical Analysis: Independent samples t test
Note: SD: Standard Deviation

Discussion

The impulsivity level and complex attention functions of individuals with substance use disorder in our study were compared with healthy controls. Gender distribution in the study is in accordance with the literature. In Asan et al. [16]'s study, 283 (93.7%) of the 302 patients with alcohol and substance use were male and 19 (6.3%) were female. In a similar study, 104 (93.7%) males and 7 females (6.3%) were found to have alcohol and substance use among 111 people [17]. According to these results, it is thought that substance use disorder can be affected by gender and it is seen more frequently in men than in women. However, this difference may be due to the fact that men are more likely to apply for treatment. The mean age of the patient group and the literature are also compatible [16]. When the findings obtained in the study and the literature information are evaluated together, it is considered that substance use negatively affects the working life of the individual. Also, findings in the study are parallel to the literature and it is thought that substance use affects the marital status [17]. The age of starting to use the substance varies according to the type of substance used. In a study, substance use before age 20 was reported as 76.6% [17]. Köksal [18] reported that 63.5% of the patients in the study had experienced past or continuing legal problems related to substance use. Findings related to the forensic problem in this study are similar to other studies. In the findings, it is considered that the people with substance use have more legal problems than the general population. According to our study, it is thought that the first substance used by those with substance use disorder is marijuana. Marijuana may be a "door-opening" substance in transition to other substances [17].

One of the important findings of this study is that the impulsivity level of the group with substance use disorder is higher than the healthy control group. Bozkurt [19] found that the Barratt impulsivity scale for alcohol and heroin addicts had higher scores on attention impulsivity, motor impulsivity, unplanned impulsivity subscales, and total impulsivity scores than the control group. Caliskan [20] found no significant difference in the Barratt impulsivity scale total score, motor impulsivity, attention impulsivity and unplanned impulsivity subscales between the groups with and without cannabis in the last 3 urine samples. Ersche et al. [21] reported that substance addicts scored higher on all subscales of the Barratt impulsiveness scale. Koksal [18] found that the group using heroin had a higher impulsivity score than those who used bonzai.

The group with substance use disorder completed TMT-B in longer duration than healthy controls. TMT-B measures complex attention function. Rosenberg et al. [22] performed TMT, Stroop test, Verbal Fluency tests and found that all of the tests resulted in a significant loss of performance in the drug-using group. Unal [23] reported that volatile substance users completed TMT-A significantly later than the control group. According to our study, complex attention is more impaired in the patient group than in the controls.

Subjects using substances have difficulties with concentration, delaying gratification, making appropriate decisions, and inhibiting responses. Moral development involves many processes related to executive functions. Some of them include reasoning ability, empathy ability, evaluating emotional cues, looking at events from different perspectives, internalizing correct behavior patterns, providing personal supervision and delaying reactions. Inadequacies in these areas cause behavior problems. Disorders related to working memory may occur in persons with substance use disorders. These are features such as making conclusions, making preparations, foresight and mimicry from complex events. For example, repetitive errors in neuropsychological tests are associated with deterioration in these processes. Another managerial function, the emotional regulation system, includes the control of emotions, motivation and alertness. Reconstruction and fragmentation of learned behaviors are also another managerial function in substance dependence. These disorders, which are described in executive functions, cause problems in the subjects of analysis and synthesis. The information obtained from longitudinal studies also focused on problems such as rapid response, focus on focus, and mood variability [24-26].

As a result; the level of impulsivity of substance users was found to be higher than the healthy control group. This result can be interpreted as impulsivity makes people tend to use substances, or it can be interpreted as substance use increases impulsivity. Another important consequence of the study is that patients with substance use has higher impaired complex attention than healthy controls. This finding may be a factor that triggers the use of the substance or it may be a result of the use of the substance. This is the first study to investigate the complex attention of the executive functioning of patients with substance use disorder in our country with the trail making test.

Limitations

Major limitation of this study is its cross-sectional design. A prospective design starting from early periods of substance use with regular follow-up scale evaluations would yield more convincing results about nature of addiction. The lack of standardized scales to make a clinical diagnosis is another limitation of this study. It is thought that there may be a relation between the scale used and education level. However, a significant difference was found between our groups in terms of education level. It is thought that the study can be repeated with study groups where the level of education is similar. The number of women in this study is low in both groups. It is difficult to adapt the results obtained for this reason to women. It may be useful to conduct studies that have a high percentage of women.

Conclusion

As a result; the level of impulsivity of substance users was found to be higher than the healthy control group. This result can be interpreted as impulsivity makes people tend to use substances, or it can be interpreted as substance use increases impulsivity. Another important consequence of the study is that patients with substance use has higher impaired complex attention than healthy controls. This finding may be a factor that triggers the use of the substance or it may be a result of the use of the substance. This is the first study to investigate the complex attention of the executive functioning of patients with substance use disorder in our country with the trail making test.

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Competing interests
The authors declare that they have no competing interest

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Ethical approval
Before the study, permissions were obtained from local ethical committee.

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