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Research Article

THE EFFECTIVENESS OF COMPUTER-BASED COGNITIVE-BEHAVIORAL THERAPY APPROACH FOR THE TREATMENT OF ATTENTION DEFICIT DISORDERS OF DRUG ADDICTS

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ABSTRACT. Attention is one of the cognitive skills that plays an essential role in human life. Various factors cause damage to cognitive function. One of the causes of impaired cognitive function is drug addiction. Drug use causes a distraction in the attention of addicted people and their attention is drawn to the symptoms related to drugs in the environment (attentional bias). In this paper, by presenting a computer-based cognitive rehabilitation method, the attentional bias of drug addicts is evaluated and treated. 15 patients participated as a control group and 15 patients addicted to methamphetamine participated as an experimental group. The results showed that before the treatment process, there was a significant difference between the mean reaction time of the experimental group (364.20 ms) and the control group (453.13 ms) in dealing with methamphetamine-related images ($p<0.05$). But after the treatment process, there was no significant difference between the mean reaction time of the experimental group (444.53 ms) and the control (462 ms). Also, before the treatment process, the reaction time of the control group (381.66 ms) in dealing with miscellaneous images was shorter than that of addicts (416.4 ms). But after the treatment process, there was no significant difference between the reaction time of the experimental group (373.06 ms) and the control (381.33 ms). Therefore, the results show that people addicted to methamphetamine are more sensitive and irritable to images and visual symptoms related to methamphetamine. The drug methamphetamine has improved in dealing with images related to this drug, so the use of this therapeutic approach during the withdrawal period is very important and reduces the likelihood of disease recurrence in this condition.

Keywords: *attentional bias, drug addiction, reaction time, methamphetamine*

INTRODUCTION

Attention is one of the cognitive skills that plays an essential role in human life that various factors cause damage to its cognitive function [1, 2]. In fact, attention makes it possible for humans to filter environmental events, in other words, it gives humans the ability to receive certain environmental information and delete some other information [3, 4]. In the process of attention, the mind clearly dominates one of several possible subjects to which it is simultaneously exposed [5]. Attention to man also makes it possible to return to work or previous thought after a certain period of time. There are different

types of attention, which are: sustained attention, selective attention and divided attention [6, 7].

Various factors cause damage to cognitive function [8, 9]. One of the causes of damage to this important cognitive function is drug addiction. Drug addiction is a chronic psychological disease that causes severe problems in the patient's motivation and behavioral balance. Drug addiction impairs the cognitive functions of the addicted person and especially the cognitive function of attention due to the physiological changes that it causes in the brain [10, 11]. One of the treatment methods for drug addicts is a therapeutic approach called cognitive rehabilitation or cognitive-behavioral therapy. Cognitive-behavioral therapy includes interventions that share the basic hypothesis that mental disorders and mental disorders are supported by cognitive factors. [Cognitive-behavioral therapy has increasingly attracted the attention of physicians and the general public, partly because of its general ideas and clear principles, self-help books have been written based on cognitive-behavioral therapy approaches to master this approach [12].

Huff and colleagues compared 38 people addicted to crack and cocaine with an average lifespan of 3.8 years to 54 regular volunteers using psychological tests. Statistical classification based on age, education, social class and level of depression has been defined and it has been concluded that drug addicts have cognitive impairments [13].

By examining 481 cocaine users and 586 healthy individuals, Yovanovsky and colleagues showed that cocaine use had a significant effect on people's attention span. Effects on visual memory and working memory were also observed. Quantitative effects were also observed on sensory-perceptual functions and verbal mastery. The results showed that cocaine use causes dysfunction of the anterior and anterior cingulate cortex, which play a significant role in attention and executive functions [14].

Beckel et al. Compared the laboratory findings of computer-based interventions on addicts with the findings of therapist-based interventions on addicts. In this study, it was found that computer-based interventions target individuals' cognitive functions. Not only do these interventions have the benefits of cost savings and availability, but they also have significant positive effects on the motivation, interaction, and treatment of drug addicts [15].

Yam et al. Note the effects of the Cognitive Rehabilitation Training System (an extended system for improving cognitive function based on the Korean Cognitive Rehabilitation Program) along with the use of white noise (20 to 20,000 Hz) on attention. And examined the memory of the elderly. In this study, 14 were considered for the experimental group and 14 elderlies for the control group. The experimental group participated in a 6-week program of attention and concentration exercises with cognitive rehabilitation training software using white voice. The control group also participated in a 6-week program of attention and concentration exercises with cognitive rehabilitation training software without using white voice. The results showed that the use of cognitive rehabilitation training software with white voice improves the attention and concentration of the elderly [16].

Carmen Batanero and colleagues examined distractions toward alcohol-related stimuli as a predictor of maintenance treatment for cocaine addicts who occasionally or recreationally used alcohol. In this study, attention deficit disorder was analyzed in 71 cocaine-dependent patients and the patterns were compared with respect to concomitant alcohol consumption or suspected concomitant alcohol use. The intensity of cravings for cocaine and alcohol was also assessed. Attention aberration was assessed using a computer-based visual probe method from eight pairs of alcohol-related images and

neutral or natural images, as well as eight pairs of cocaine-related images and neutral or natural images. Intensity of cocaine craving was also assessed using a Spanish drug craving questionnaire. The results showed that cocaine-dependent patients and occasional or recreational alcohol consumption in the face of alcohol-related stimuli show a pattern of avoidance in the face of cocaine and alcohol-related stimuli. Distraction from alcohol-related stimuli is the only predictable variable, and therapeutic strategies including deep emotional processing or avoidance strategies need further investigation [17].

Rami Monem and colleagues examined the attention deficit in alcoholics to various stimuli using a visual probe test. The results showed that attention deficit (measurement of stabilization time to stimulation in visual probe activity) was dependent on alcohol symptoms depending on the dose of alcohol consumption, while attention deficit on food symptoms was not affected by dose. Therefore, the results showed that alcohol consumption reduces the distraction towards alcoholic stimulation while it does not have a significant effect on other stimuli [18].

Andy Dean and colleagues have identified distraction to drug-related stimuli as one of the hallmarks of drug addiction and have shown that the degree of distraction is related to cravings and drug-related behavior [19].

According to the relevant records mentioned, drug use and addiction cause cognitive deficits in the addicted person and one of the most important cognitive deficits caused by drugs is the distraction of addicted patients to the symptoms. It is related to drugs. Most of the studies and methods presented for cognitive rehabilitation of drug addicts include previous methods designed for brain injuries such as schizophrenia or brain trauma, which are specific to cognitive rehabilitation. People addicted to drugs are not designed [20]. Also, in many of these methods, no specific strategy is considered to motivate patients to participate in and complete the course of treatment. One of the approaches to motivate people is to use and display images with topics of interest to people, because displaying images with specific topics for people, will cause their emotional reaction [21].

The use of computer approaches increases the motivation for drug-addicted patients to participate in treatment sessions. But the important point is that common methods of cognitive rehabilitation of addicts are methods that are designed and developed to treat patients with brain injuries and therefore no specific computer-based method for cognitive rehabilitation of the attention function of addicts is provided. Has not been.

Various studies have been done in the field of medical engineering [22, 23].

Given the importance of providing a specific and comprehensive method for cognitive rehabilitation of drug addicts and motivating patients to continue participating in this therapeutic approach, in this article we present a computer-based cognitive rehabilitation method to assess and improve deviation. The attention of drug addicts is presented. Through the use of images with topics of interest to patients, the necessary motivation to complete the treatment process is created in these people. The specific objectives of this study are: (1) Assessing the degree of distraction of the participants of the control and experimental group towards the symptoms and images related to drugs, as well as natural and neutral images, by means of a computer program evaluation program. (2) Correction of distraction of drug addicts by using a computer program of treatment programmed and completed during twelve sessions of treatment (3 sessions per week) and (4) Evaluation of the improvement in distraction of patients addicted to drugs Towards drug-related signs and images by a computer program evaluated to determine the effectiveness of the programmed computer.

The structure of the article is as follows. After stating the problem and the importance of the subject in the introduction, in the second part, materials and research methods such as statistical population and data collection tools are stated. Descriptive statistics of research variables and data analysis are mentioned in the third part. Finally, conclusions and discussion are given in the fourth part, which states the results of the article for two hypotheses.

MATERIALS AND METHODS

Considering the importance of providing a specific and comprehensive method for cognitive rehabilitation of drug addicts and motivating patients to continue to participate in this therapeutic approach, in this article, by presenting a computer-based cognitive rehabilitation method, evaluate and improve Distraction has been done to drug addicts. Also, through the use of images with topics of interest to patients, the necessary motivation to complete the treatment process is created in these people.

Statistical Population

The statistical population is patients addicted to methamphetamine drug located in the addiction treatment center of young founders in Najafabad in the year 1998-97. Amphetamine is a stimulant drug used in psychiatry that improves cognition in healthy people, but in people with neurocognitive diseases, its use causes a kind of cognitive deficit called hyperactivity. There are other cognitive disorders. 30 people (15 in the control group and 15 in the experimental group) participated in this study. The control group includes people without dependence on any opioids or narcotics. Due to the fact that cognitive functions change with age, in order to eliminate as many errors as possible, both the control group and the experimental group were selected in the age range of 20 to 30 years. Multi-stage cluster sampling method was used to select the participants of the experimental group, so that first methamphetamine-addicted patients were separated from other drug-addicted patients and then drug-addicted patients. Methamphetamine drugs, ranging in age from 20 to 30 years, were selected from these patients.

It should be noted that for this research, the approval of medical ethics has been obtained in the ethics committee in biological research with the ID IR.IAU.NAJAFAB-AD.REC.1397.069. Individuals sign an informed consent form before participating in the study.

Data Collection Tools

In this study, a questionnaire provided by researchers at Johns Hopkins University was used to diagnose whether or not people are addicted to drugs. This questionnaire includes 20 questions related to drug abuse, occasional or recreational drug use and other issues related to drug use, the answers to which are yes or no. At the end, the participant is given points based on the number of questions that are answered yes. The scoring system in this case consists of 4 stages, which include the probable stage, the first stage (close to drug addiction), the second stage of drug addiction (in this case, the tendency and consumption is more than the previous stage, but to Has not reached its maximum.) And the final stage in which the tendency and drug addiction has reached its maximum.

If the answer to three of the questionnaire questions is yes, there is a possibility that the person has a drug problem. If the answer to 4 to 7 questions is yes, the person is in the near stage of drug addiction. Also, if the answer to 7 to 10 questions is yes, the person is in the second stage of drug addiction, and if the answer to more than 10 questions is yes, the person is in the final stage of drug addiction [24].

Type and Method of Research

Initially, a computer program was developed using the C ++ programming language to assess the attention deficit of the participants in the control group and the experimental group. To use a computer program, patient information is first recorded, including name, age, education, type of drug used, duration of drug dependence and addiction, age of onset of drug use, marital status and occupation of the patient. Is.

In the evaluation program, participants take 10 tests (in each test, a pair of images, one of which is related to different drugs and the other uses a neutral or natural image). It should be noted that the order of display of pairs of images for each participant is random. In the attention deficit assessment program, the computer-based visual probe method is used.

In this way, first the fixation sign (+) appears in the center of the screen for 500 milliseconds, then two images measuring 18 x 13 cm at a distance of 3 cm next to each other by the screen to 1000 milliseconds are displayed for the test participant. However, one of the two images is related to drugs or accessories related to its use, and the other image contains a natural and neutral image that can contain any subject other than drugs. The images then disappear, and for a period of 150 to 750 milliseconds randomly after the images disappear, a visual cue or probe (for example, the English letter x), to the left or right of the screen (where one of the images is shown Appears in it) appears. The patient must then press one of the two defined keys with maximum speed and accuracy based on the location of the sign that appears (if the visual probe appears on the left, the participant must press the "A" key; if The visual probe appears on the right. The participant must press the "D" key). The interval when the participant presses the relevant key after the probe appears is also considered as the reaction time.

People are given points based on the performance of the participants in this test. The main point of this test is that if the probe or visual cue appears in the previous location where the image was related to the drug, the addicted person, based on the theory of attention deficit, shows a faster reaction than the other case. Indicates the distraction of the addicted person towards the image of drugs. Also, if the participant presses the wrong button in relation to the location of the probe, and also in case of delay in pressing the relevant button, a negative point will be considered for the participant. The mean evaluation scores of the control group, a standard index of scores, in relation to the normal functioning of cognitive function of attention and accordingly with the participation of drug addicts in this evaluation program, the distraction of these patients in the face Detection can be identified and evaluated with drug-related visual stimuli.

The computer treatment program is configured like the evaluation program using the C ++ programming language. There are 10 categories for photos, and each category contains a specific subject. Participants should choose images that are in their area of interest and evoke positive emotions and personal motivation. In contrast, the pictures of different drugs are shown to the addict and he is asked to choose the pictures of the drugs he is consuming along with the pictures of the necessary accessories for their use. During

this program, as in the patient evaluation program, they must react to the images displayed. At the beginning of the treatment period, most of the exercises contain images of drugs for the patient, and as the treatment period progresses, the images of drugs gradually decrease and are replaced by motivational images of patients. At the end of the treatment period, when the patient's attention is turned to drugs, based on the condition created for the patient, the desired motivational images are associated with him and thus provoke the patient's emotional response and deterrence. In the results section of the computer program, you can search for the first and last name of the people. The reaction times of the participants in each of the phases of primary evaluation, treatment and secondary evaluation, as well as the location of the visual probe (former location of the image). Opioid or neutral) observed [Table (1)].

After the treatment period, in order to evaluate the effectiveness of the treatment program, using the computer evaluation program, the patient 's distraction in facing the image of drugs and neutral images was evaluated again and the obtained scores were compared with the standard score index.

Table 1. *Individuals' reaction times in the computer program results section*

Test number	Result in milliseconds	Selected image
1	338	Drugs
2	310	Miscellaneous
3	278	Miscellaneous
4	199	Drugs
5	372	Drugs
6	283	Miscellaneous
7	347	Miscellaneous
8	375	Miscellaneous
9	271	Drugs
10	366	Drugs

PROCESSING RESEARCH FINDINGS

Tables 2 and 3 show the mean and scatter time of reaction to drug images and miscellaneous images, respectively, for the experimental and control groups. As can be seen, the average reaction time to drug images in the initial evaluation (before treatment) in the experimental group was 364.20 milliseconds, which increased to 444.53 milliseconds in the final evaluation (after treatment). Also, the average reaction time to miscellaneous images in the experimental group in the initial evaluation is 416.44 ms, which in the final evaluation has decreased to 373.6 ms. The trend graph of the mean reaction time of the experimental group to the images of drugs and motivation during the treatment period is shown in Fig. 1. In this figure, the horizontal axis shows the meeting number and the vertical axis the time in milliseconds. As can be seen, the mean reaction time to drug images was low at the beginning of treatment and increased during treatment sessions and was almost constant in the last three sessions of treatment. Also, the reaction time to motivational images was high at the beginning of treatment and decreased during the first 5 sessions of treatment and was almost constant in the next 5 sessions. The

frequency of errors during training sessions is shown in Table 4. As can be seen, the number of errors compared to the drug images at the beginning of treatment was small and decreased during the treatment period. Also, the number of errors compared to motivational images at the beginning of treatment was high and decreased during the treatment period. In total, the number of errors decreased during the treatment period.

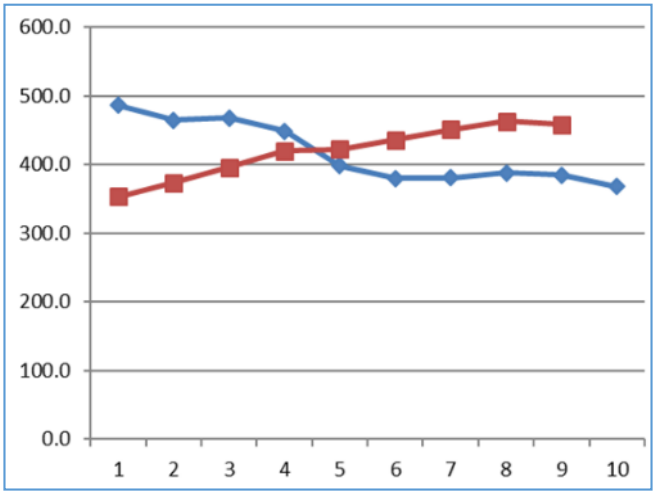

Fig. 1. *Graph of the average reaction time of the experimental group to drug and motivational images during the treatment period*

Table 2. *Mean and scattering time of reaction to drug images by two groups*

Standard deviation	Average (ms)	Condition	Group
23.68	364.20	Initial evaluation	Experiment
39.88	444.53	Final evaluation	
57.93	453.13	Initial evaluation	Control
32.39	462	Final evaluation	

Table 3. *Mean and scatter of reaction time to miscellaneous images by two groups*

Standard deviation	Average (ms)	Condition	Group
28.57	416.4	Initial evaluation	Experiment
70.96	373.06	Final evaluation	
18.99	381.66	Initial evaluation	Control
17.91	381.33	Final evaluation	

Table 4. *Frequency of number of errors during training sessions*

Total error	Frequency of errors in response to motivational images	Frequency of errors in response to drug images	Meeting number
8	5	3	1
5	3	2	2
7	4	3	3
6	2	4	4
5	2	3	5
4	1	3	6

4	2	2	7
3	1	2	8
1	0	1	9
1	0	1	10

The mean and scattering time of reaction to drug images in the pre-treatment and post-treatment stages are shown in Table 5. As can be seen, the average reaction time to drug images increased after treatment.

Table 5. *Comparison of mean reaction time before and after treatment*

Standard deviation	Average	Number of samples	Meeting number	Variable
23.68	364.20	15	Before treatment	Reaction time to drug images
39.88	444.53	15	After treatment	

Conformity test Kolmogorov-Smirnov test [25, 26] was used to compare the extracted properties with the standard normal distribution. Since none of the features had a normal distribution, the Mann-Whitney test is used to examine and characterize significant differences between features under different conditions. The results of statistical test showed that the mean reaction time to drug images in the pre-treatment and post-treatment stages were significantly different ($p < 0.05$).

In this section, by repeating the display of images to reduce the rate of drug-related images, the patient gradually learns to turn his attention to his topics of interest and motivation when his attention is focused on drugs.

The statistical results of Table 6 show that the average reaction time to motivational images in the initial stage of treatment is 386.73 milliseconds, which at the end of the treatment period is reduced to 325.61 milliseconds, which are different. Using statistical test, the existence of a significant difference in these results was confirmed ($p < 0.05$).

The results show that there is a significant decrease between the reaction time to motivational images in the initial stage of treatment and the end of the treatment period ($p < 0.05$) in the pre-treatment stage between the reaction time to drug images between addicts and controls (healthy individuals). There was also a significant difference ($p < 0.05$). Also at this stage there is a significant difference between the reaction time to various images between addicts and the control group (healthy people). But in the post-treatment stage, there is no significant difference between the addicts and the control group (healthy people) for the variables of reaction time to drug images and reaction time to various images.

Table 6. *Comparison of response time averages before and after treatment*

Standard deviation	Average	Number of samples	Meeting number	Variable
98.59	386.73	15	First session	Response time to motivational images in milliseconds
65.59	325.61	15	Last session	

CONCLUSION

Attention is one of the cognitive skills that plays an essential role in human life. In fact, attention makes it possible for humans to filter out environmental events, in other words, it gives humans the ability to receive some specific environmental information and delete some other information. Various factors cause damage to cognitive function. One of the causes of damage to this important cognitive function is drug addiction. Drug addiction is a chronic psychological disease that causes severe problems in the patient's motivation and behavioural balance [27]. Common theories about addiction state that drug abuse increases the sensitivity of dopamine pathways in the brain that are specifically related to motivation and reward, and increases dopamine secretion in the brain. This increase in dopamine sensitivity increases the desire or motivation to use drugs, which makes people addicted to drugs conditioned. In fact, multiple drug use or exposure to it has created a prominent motivation in relation to drug use, and as a result, when confronted with drug symptoms (such as the image of drugs), the conditional state of motivation in consumption Active drug producers. This motivational state causes the addicted person to turn his attention to stimuli and drug-related symptoms [28]. As a result, people addicted to drugs selectively turn their attention to drug-related symptoms in the environment. This allocation of attention to drug stimuli over a period of time is called drug distraction.

One of the treatment methods for drug addicts is a therapeutic approach called cognitive rehabilitation or cognitive-behavioural therapy. In this article, by presenting a computer-based cognitive rehabilitation method, the deviation of attention of drug addicts is evaluated and improved. Also, through the use of images with topics of interest to patients, the necessary motivation to complete the treatment process has been created in people.

The results showed that before the treatment process, there was a significant difference between the reaction time of methamphetamine addicts (experimental group) and the control group (healthy individuals) in the face of methamphetamine-related images. In fact, before the treatment process, addicts had less time to respond to drug-related images than controls. But after the treatment process, there was no significant difference between the reaction time of methamphetamine addicts and the control group. There is also a significant difference between the reaction time of methamphetamine addicts and the control group in dealing with miscellaneous images. Thus, before the treatment process, the control group had less reaction time in the face of miscellaneous images than addicts. But after the treatment process, there is no significant difference between the reaction time of methamphetamine addicts (experimental group) and control group (healthy individuals). Therefore, the results show that people addicted to methamphetamine are more sensitive and irritable to images and visual symptoms related to methamphetamine.

According to the results of Table (5), the reaction time of addicts in dealing with images related to this drug and its special devices, has increased significantly, and between the reaction time of addicts before the treatment process and after the process. There is a significant difference in treatment. In fact, increasing the reaction time in dealing with images related to the drug indicates the effectiveness of the treatment process in reducing irritability and sensitivity in dealing with the visual signs and symptoms related to the drug methamphetamine. Therefore, reducing the rate of drug-related images and its equipment and increasing the motivational and favourite images of the person in the computer program for the treatment of drug-addicted patients, reduces the patient's distraction to the symptoms and images related to drugs. This issue is especially important

for the addicted patient during the period of drug withdrawal, because the patient is exposed to the signs and symptoms related to the drug, the possibility of activating the dopamine system (conditioned on drug use) and It distracts the addicted person towards drug re-use and provides a recurrence of drug abuse, which is one of the most important risk factors in the process of quitting the drug-addicted patient.

Considering that the treatment process proposed in this article has improved the distraction of methamphetamine-addicted patients in dealing with images related to this drug, so the use of this therapeutic approach in the withdrawal period is of great importance. And reduces the likelihood of disease recurrence in this condition.

The results of Table (6) show that the reaction time of methamphetamine addicts in the face of motivational images has been significantly reduced and between the reaction time of addicts in the face of motivational images in the first session of the process. There is a significant difference between the treatment and the final session of the treatment process, which indicates an increase in the irritability of addicted patients to the motivational images at the end of the treatment process.

Another important issue is to consider motivational images as stimulus images, and the difference with drug images is that these images are considered as positive stimuli. In fact, when confronted with motivational images, the dopamine system or reward system is activated in the addicted person, and in fact the addicted person becomes conditioned towards these images or motivational issues. This improves and strengthens the addict's motivation towards motivational issues. Therefore, when the addicted person is confronted with visual signs and symptoms and due to the placement of motivational images next to drug images and increasing their display rate in the treatment process and due to the process of conditioning the methamphetamine addicted patient Motivational visual signs and symptoms, images and motivational subjects along with the pleasure and craving of the addicted person in order to use the drug, are associated with the addicted person and as a result this can have a deterrent effect on the recurrence of drug use. Be. Therefore, by repeating the display of images to reduce the rate of drug-related images, the patient gradually learns to turn his attention to his subjects of interest and motivation when his attention is focused on drugs.

Due to the fact that in the treatment process used in this study, motivation (motivational images) has been used as the main tool of treatment, so this treatment process is considered as an approach of cognitive-behavioural therapy. According to various theories of cognitive-behavioural therapy, cognitive processes play an important role in maintaining a particular procedure or behavior, so it can be concluded that a computer program or treatment process is presented. In this article, the cognitive processes of the addicted person are developed in order to maintain withdrawal or avoid drug reuse. The results show that the treatment process used in this study can be considered as an effective approach in the treatment of diversion of methamphetamine addicts to the signs and visual symptoms related to this drug. As a result, the written computer program can be used in medical centers, clinics and addiction treatment centers, cognitive rehabilitation centers.

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