

Abstract

Objective: The present study was an attempt to examine the effectiveness of therapeutic community in executive functions and autobiographical memory in people with addiction to stimulants. **Method:** This study was conducted based on a quasi-experimental research design along with pretest and posttest. From among the male stimulant users who had referred to Vardij medical center of Tehran therapeutic community, the number of 27 participants was selected via purposive sampling after the consideration of inclusion and exclusion criteria. From admission to end treatment stage of people in this center (4-month treatment), Wisconsin Test, Stroop Test, Tower of London Test, Digit Span, and Autobiographical Memory Test were used for data collection. **Results:** The results of the study showed that therapeutic community significantly improved scores of Wisconsin, Stroop, tower of London and digit span tests, as well as scores of specific autobiographical memories. **Conclusion:** Based on the effects of etiology, treatment, and prevention of executive functions and autobiographical memory on addiction, it is recommended to use therapeutic community in treatment interventions and addiction relapse.

Keywords: Addiction, Autobiographical Memory, Executive Functions, Stimulant, Therapeutic Community

Effectiveness of Therapeutic Community in Executive Functions and Autobiographical Memory in People with Addiction to Stimulants

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Introduction

Addiction is a disorder with chronic relapsing that is characterized by impulsive behaviors in search of drugs despite negative consequences of drug use (Milton & Everitt, 2012). In addictive disorders, relapsing has been defined as return to drug use after a period of abstinence. Even after years of abstinence, there is also the possibility of relapse. For this reason, addiction relapse is considered the main treatment obstacle in addictive disorders (O'Brien, 2006). Despite all the progress made in the treatment of physical symptoms of drug withdrawal, little progress has been made in the treatment of craving and desire to addiction relapse. This issue is more strongly highlighted in addiction to stimulants (Nestler, 2002). Compared with other forms of addiction, including behavioral addiction and opiate addiction, addiction to stimulants is followed by a higher number of disruptive mental and behavioral features (Alipour, Poursa'ead & Hassani, 2015). Memory is one of the most important factors associated with craving for drug use where this relationship has been recognized between stimulants and brain imaging (Ray, Hanson, Haney, Biswal & Hanson, 2015). The use of addictive drugs is followed by damages to attention, memory, and other cognitive abilities (White & Swartzwelder, 2005). Addiction reduces activity in the brain areas responsible for short-term memory, attention, and executive functions. Brain imaging studies have shown that methamphetamine use causes abnormalities in the frontal and temporal regions (Volkow et al., 2001). In previous studies, it has been found that some damages arising from the use of stimulants occur in the working memory (Bolla, Funderburk & Cadet, 2000), verbal learning (Kelley, Yeager, Pepper, Bornstein & Beversdorf, 2007), recalling the words and learning (Fox, Jackson & Sinha, 2009), and executive function (Alipour, Sa'eadpour & Peiman, 2015). Stimulants cause many abnormalities in several brain functions. These substances cause some damages to frontal, temporal and subcortical brain regions (Volkow et al., 2001). The use of stimulants leads to deficits in learning, delayed recall, information processing, and working memory (Rippeth et al., 2004). One of the aspects of memory that is affected is executive function. Group executive functions are the high-level cognitive processes that are responsible for self-regulation and goal-directed behaviors (Barkley, 1997). Defect in this ability has been recognized as a risk factor for addiction. Neurological trauma resulting from drug use relapse are among the most important damages caused by drug use (Yucel, Lubman, Solowij & Brewer, 2007).

Autobiographical memory is another memory dimension that is damaged in the process of addiction (Gandolphe, Nandrino, Hancart & Vosgien, 2013). Autobiographical memory is a memory aspect that deals with the renewal of one's personal past memories, experiences, topics, and events (Williams & Dritschel, 1988). Autobiographical memory is related to personal history, personal experiences, and the meaning of these experiences (McAdams, 2001). Autobiographical memory plays a crucial role in problem-solving process. The

autobiographical memory that is mixed with holism has a negative effect on problem solving because problem definition and production of alternative solutions require sufficient ability to use the information repertoire of memory (Williams & Dritschel, 1998).

People with substance abuse problems avoid retrieving personal memories. Eiber, Puel & Schmitt (1999) conducted a study on heroin users and showed that these individuals have undergone holism in autobiographical memory. Several studies have referred to the presence of autobiographical memory impairment in people with addiction, including alcohol users (D'Argembeau, Van Der Linden, Verbanck & Noël, 2006; Nandrino et al., 2014) and users of addictive substances (Gandolphe & Nandrino, 2010; Gandolphe et al., 2013). Holism pertaining to autobiographical memory in people with addiction is associated with decreased ability to solve problems pertinent to drug addiction (Pollock & Williams, 2001). In fact, the problem-solving ability is among the harmful factors in the individuals' lifestyle and behaviors leading to drug use (Gandolphe et al., 2013).

Therapeutic community is one of the treatments with high efficacy in increasing mental health in different patient groups, including people with amnesia, personality disorders, and addiction (De Bruin et al., 2009). Treatment of drug addiction is very complex and requires multidimensional interventions. Therapeutic community is one of the most essential components of therapy in treatment interventions of addiction domain (Levin et al., 2004). This residential treatment program provides comprehensive interventions for individuals that lead to changes in lifestyle, stability in drug abstinence, development of social skills, and reduction of high-risk behaviors (Bunt, Muehlbach & Moed, 2008). Therapeutic community is a treatment method based on group therapies, which regards the social environment as the most important factor in recovery from the use of addictive drugs (DeLeon, 2000). Decision-making, personal responsibility, and recovery along with other items of the same type are the therapeutic factors of this program (Bratter, Bratter, Radda & Steiner, 1993). It is also possible to refer to the employment of mental training, music therapy, occupational therapy, and some training for the families of the residents (Campling & Haigh, 1999), all these factors are effective in improving executive functions and autobiographical memory (Li, Wang, Chou & Chen, 2015; Raglio, Farina & Giovagnoli, 2014). Therapeutic community is effective in treatment of addiction and does not significantly differ from other treatment methods (Prendergast, Podus, Chang & Urada, 2002). In previous studies, it has been referred to the prevalence of neuropsychological problems in people with addiction participating in therapeutic community program (Fernández-Serrano, Pérez-García, Perales & Verdejo-García, 2010), which has negative effects on working, family, and social relationships of these people (Moriyama et al., 2002). In addiction intervention programs, executive function is an essential component of any successful health program (Teichner, Horner, Roitzsch, Herron & Thevos, 2002). Recent findings in this area suggest that addiction

reduces the specific aspects of autobiographical memory (Gandolphe et al., 2013). The decrease of specific aspects of autobiographical memory leads to a significant ability to predict functional competencies and negative emotions among addicts (Agnihotri et al., 2014). Holistic autobiographical memory can lead to the reduction of people's coping abilities against craving for drug use and can make the person vulnerable in the face of drug use relapse through influencing problem-solving skills (Debeer et al., 2012), rumination, decreased working memory capacity, and an increase in negative mood (Raes, Schoofs, Griffith & Hermans, 2012). On the other hand, executive functions influence problem-solving skills, cognitive flexibility, goal pursuance, and other cognitive abilities and, thereby, can lead to vulnerability and reduction of individuals' coping skills against relapse and craving for drug use (Connolly, Foxe, Nierenberg, Shpaner & Garavan 2012). Since effective addiction treatments should pay special attention to the factors effective in relapse to and craving for drug use and reduce these factors (Brorson, Ajo Arnevik, Rand-Hendriksen & Duckert, 2013), the main purpose of this study was to evaluate the effectiveness of therapeutic community in executive functions and autobiographical memory among people with addiction to stimulants.

Method

Population, sample, and sampling method

A quasi-experimental research design along with pretest and posttest was employed for the conduct of this study. It should be noted that selection of the control group that use no drugs at all and receive no treatment after four months of detoxification was not possible since addiction tests are given to the participants in therapeutic community per week and individuals should remain without the use of any drugs during four months of residence. Indeed, it was not possible to fully control these conditions for the control group; therefore, no control group was formed in this study. In addition, it was not possible to go for evaluation in the follow-up stage due to the residence of individuals in different cities. All the male stimulant users who had referred to Vardij medical center of Tehran therapeutic community in the second half of 2014 constituted the statistical population of the study. From among this population, the number of 27 participants was selected via purposive sampling after the consideration of inclusion and exclusion criteria. Criteria for the inclusion of participants in this study contained the successful completion of detoxification period, holding at least junior high school education, and informed consent to participate in the research. On the other hand, withdrawal from treatment, slip from treatment, and expulsion from treatment constituted the exclusion criteria. In this study, the clients were assessed in two shifts, i.e. the pretest (admission) and posttest (four months after treatment).

Instrument

1. Wisconsin Card Sorting Test (WCST): This test was developed by Grant & Berg (1948; cited in Lezak, Howieson & Loring, 2004). The number of 64 cards constitutes the tools of this test. On these cards, there are some images with different colors (red, yellow, blue and/or green), different shapes (cross, circle, triangle and/or star), and different number (from one to four). This test is used to evaluate executive functions (Heaton, 1981). Three main variables, namely number of categories completed, preservative error, and total error are required in the calculation of the results of this test

2. Stroop Color and Word Test: This test was designed by Ridley Stroop in 1935 for the measurement of selective attention, processing speed, and cognitive flexibility (cited in Zare, Farzad, Alipour & Nazer, 2012). In Stroop test, subjects are presented with three cards. The first card contains several dots in green, red, blue, and yellow and the examinee is asked to name the colors. A high number of words in green, blue, yellow, and red have been printed on the second card and the participant should name the color of words regardless of the words. The words green, red, blue, and yellow have been printed on the third card with colors other than the words and the respondent should state the names of colors regardless of the meaning of words. Error and the time taken to read each card are recorded. The difference in the time taken to read the first and third cards is used as an indicator of differentiation (Ghadiri, Jazayeri, Ashayeri & Ghazi Tabatabai, 2006).

3. Tower of London Test: This test was constructed by Shallice in 1982. This test is an important instrument for measurement, planning, and organization. In this test, the scores of delayed time (from the initiation time to the first move made by the person), test time (from the first move to completion of the first attempt), total time (the sum of the delayed time and test time), the number of errors, and the total score are calculated by computer. The reliability of this test has been reported equal to .79, which is acceptable (Lezak et al., 2004).

4. Digit Span Test: This instrument is used to assess short-term memory and attention (Westerberg, 2004). This test requires attention and encoding; and the participants should keep in mind the information for a short time, perform operations on it, and then tell it (Nejati & Alipour, 2015). Alpha coefficient of the scale has been obtained .65 and its retest reliability coefficient has been reported to equal .83 (cited in Orangi, Atefvahid & Ashayeri, 2002).

5. Autobiographical Memory Test (AMT): This test was designed to measure autobiographical memory, which was first used by Williams & Broadbent (1986) in working with suicidal patients. The test includes the provision of some signs for the words with emotional connotation. The examinees are told to express the word that is recalled by the event (memory). The recalled event can be of high or low importance, can pertain to the recent or past period, but it should be a special event. In fact, the event must have happened at a certain time

and place and should take a limited duration (one day or less). Participants are given an example of what we offer as exclusive. For example, the response “I usually enjoy a party” is not correct for the word “enjoyment” since it does not refer to a specific time or place. Thus, the response “Ali’s party on last Friday” is correct. During some attempts, it is ensured whether the participants have properly understood the training. Williams & Broadbent (1986) considered one minute for giving answers. In subsequent studies, 30 seconds was considered necessary to provide answers. Failure to respond within the specified time is coded as specific; otherwise, it is coded as non-specific or extremely coded. In this analysis, only the coding pertaining to specific memories enters the study.

Procedure

Therapeutic community consists of a 4-month period wherein the participants enter the therapy after detoxification. Daily predetermined programs, including psychosocial training, occupational therapy, music therapy, group therapy, and individual psychotherapy were offered to the participants, addiction tests were given to the participants per week, and the participants were extremely controlled in order not to take drugs. For executive functions in this study, Wisconsin Card Sorting Test was used to assess set shifting, Stroop test was used to assess inhibition, Digit Span test was used to assess working memory, and the Tower of London test was used to evaluate planning and organization. During the study, two experimenters took an active part and conducted the evaluations in a room with proper psychometric conditions in a quite favorable situation. These tests were administered by giving examples and detailed explanations about them.

Results

The mean and standard deviation for the age of the participants were 31.5 and 7.30, respectively. In terms of marital status, 51% of the participants were married and 49% were single. Furthermore, 81% of them were employed and 19% were unemployed. The mean and standard deviation for the duration of drug use (such as cocaine and amphetamines) among the participants were 6.4 and 3.10, respectively. To investigate the difference between pre-test and post-test scores, t-test was used. One of the assumptions of using this test is the normal distribution of the data. To this end, Kolmogorov-Smirnov test was run and its results are provided in the table 1.

Table 1: Results of Kolmogorov-Smirnov test representing the normality of distribution

	<i>Mean</i>	<i>SD</i>	<i>Positive difference</i>	<i>Negative difference</i>	<i>Z score</i>	<i>Sig.</i>
Wisconsin (pre-test)	95.03	25.12	.16	-.11	.84	.478
Wisconsin (post-test)	77.04	16.73	.09	-.13	.68	.738
Stroop (pre-test)	100.04	14.40	.13	-.07	.72	.674
Stroop (post-test)	91.37	10.85	.07	-.11	.60	.860
Tower of London (pretest)	451.40	57.87	.09	-.11	.57	.898
Tower of London (post-test)	433.00	32.33	.06	-.09	.50	.961
Autobiographical Memory (pre-test)	8.35	2.54	.10	-.14	.71	.689
Autobiographical Memory (post-test)	6.11	2.19	.09	-.13	.72	.673
Digit Span (pre-test)	3.41	1.11	.16	-.18	.95	.324
Digit Span (post-test)	2.22	1.31	.16	-.13	.83	.495

The results of t test analysis for Stroop test are presented in the table below.

Table 2: Results of t test analysis for Stroop test

<i>Variable</i>	<i>Pre-test</i>		<i>Post-test</i>		<i>T test results</i>		
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>df</i>	<i>t</i>	<i>Sig.</i>
Time of the first stage	22.70	3.79	21.74	3.43	26	1.32	.198
Error of the first stage	2.37	1.36	1.67	.92	26	3.54	.002
Time of the second stage	22.93	3.65	22.26	3.33	26	1.67	.106
Error of the second stage	1.93	1.07	1.15	.77	26	3.15	.004
Time of the third stage	33.15	5.23	32.26	5.53	26	.98	.333
Error of the third stage	4.67	2.96	3.04	1.19	26	2.55	.017
Time difference between the first and third stages	11.30	4.30	9.26	4.34	26	2.21	.036

As it can be observed in the above table, therapeutic community has reduced errors in the three stages and difference in scores. The results of t-test for the variables of Wisconsin Card are presented in the table below.

Table 3: Results of t-test for the variables of Wisconsin Card

<i>Variable</i>	<i>Pre-test</i>		<i>Post-test</i>		<i>T test results</i>		
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>df</i>	<i>t</i>	<i>Sig.</i>
Completed categories	2.33	1.56	3.04	1.19	26	-3.42	.002
Preservative error	30.52	12.15	26.59	9.29	26	1.71	.098
Total error	60.48	18.99	44.30	11.34	26	7.16	.0005
Failure to maintain the categories	3.11	1.47	1.70	1.23	26	5.46	.005

As it can be observed in the above table, therapeutic community has reduced errors and failure to maintain the categories and has increased the scores of

completed categories in Wisconsin Card test. The results of t-test for Digit Span test are presented in the table below.

Table 4: Results of t-test for Digit Span test

<i>Variable</i>	<i>Pre-test</i>		<i>Post-test</i>		<i>T test results</i>		
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>df</i>	<i>t</i>	<i>Sig.</i>
Completed categories	2.22	1.31	3.41	1.11	26	-3.92	.001

As it can be observed in the above table, therapeutic community has increased the scores of Digit Span test. The results of t-test for Tower of London test are presented in the table below.

Table 5: Results of t-test for Tower of London test

<i>Variable</i>	<i>Pre-test</i>		<i>Post-test</i>		<i>T test results</i>		
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>df</i>	<i>t</i>	<i>Sig.</i>
Total time	204.41	28.02	194.89	16.22	26	2.61	.015
Delay error	26.11	6.84	22.74	5.46	26	3.88	.001
Test time	122.89	23.57	171.44	11.95	26	1.83	.078
Error	22.07	4.69	19.22	3.22	26	3.79	.001
Point	20.93	5.02	24.70	3.19	26	-3.99	.0005

As it can be observed in the above table, therapeutic community has reduced total time, test time, and error and increased the scores of points. The results of t-test for Autobiographical Memory are presented in the table 6.

Table 6: Results of t-test for Autobiographical Memory

<i>Variable</i>	<i>Pre-test</i>		<i>Post-test</i>		<i>T test results</i>		
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>df</i>	<i>t</i>	<i>Sig.</i>
Specific	6.11	2.18	8.48	2.59	26	-3.61	.001
Positive	3.09	1.49	4.48	1.76	26	-3.05	.005
Negative	3.16	1.18	4.06	1.68	26	-2.23	.034

As it can be observed in the above table, therapeutic community has increased the scores of all the three types of Autobiographical Memory.

Discussion and Conclusion

The results of data analysis showed that therapeutic community improves executive function in people with drug addiction. Due to the use of music therapy, occupational therapy, and training in therapeutic community, the results of this study are consistent with those of previous research (Karimi, Zare & Hadianfard, 2011; Bahmani, Zandi Ghashghai & Khosravi, 2014; Lee et al., 2015; Raglio et al., 2014) and the results suggest that occupational therapy improves executive functions (Vizzotto et al., 2014). Today, therapeutic community is recognized as a treatment with positive results, lower costs, lasting changes, and provision of multidimensional training programs (including

behavioral patterns, group therapy, psychosocial training, individual psychotherapy, and creation of an environment free of drugs) and plays a major role in the treatment of addiction. This treatment program can treat not only addiction, but also a wide range of psychiatric disorders axis I and II. This treatment program leads to the acceleration of treatment process by modifying behavior patterns, observational learning, training, group therapy, and spending a relatively long time in an environment without the stimulant drugs (Haigh, 2015). There is a relationship between cognition and music. Collier & Logan (2000) believe that short-term memory holds a better function when it enjoys alternate rhythmic auditory stimulations than when visual stimulation is used. Music leads to memory improvement through mental imagery (cited in Khalaf Beigi, Bayanzadeh, Zadehmohamadi & Shafadavoodi, 2006). Gregory (2002) believed that the persistence of music attention is effective in cognitive processes, particularly with indirect focusing on joyful experiences. There are several signs and clues that indicate the neural networks specific to music process in the brain act independently and separately (independent of other neural structures) (cited in Khalaf Beigi et al., 2006). Recent studies have confirmed music effectiveness in the production of alpha brain waves (Ericsson, 2006) and the temporal brain activities (Malayeri, Jafari & Ashayeri, 2005). Music is widely used to improve health, reduce stress, and ward off the unpleasant symptoms. Music also exerts direct psychological effects on the autonomic nervous system. Music leads to the construction and enhancement of connections between neurons in the cerebral cortex. This means that, in the environments with music, cycles of neurotransmitters between neurons are created and stimulate higher parts of the nervous system that pertain to memory and cognition (Kemper & Danhauer 2005).

Occupational therapy can be effective in reducing memory problems and act as a factor in reducing stress through the preparation and development of regular working programs in line with individual interests and specialties. Occupational therapy is effective in improving cognitive deficits by the review of past abilities of people and creation of an opportunity to practice these skills again. In addition, occupational therapy leads to the establishment of social interaction, relaxation, and the reduction of anxiety through the social environments it provides. All these items can be effective in the improvement of cognitive function (Ng et al., 2006). To account for these findings, one can refer to the improvement of the quality of life for these people (González-Saiz et al., 2011). This improvement of the quality of life is one of the factors effective in improving cognitive and executive functions (Giovagnoli et al., 2014). Moreover, therapeutic community plays a major role in changing the lifestyle of people by means of such factors as music therapy, occupational therapy, regular physical exercise, and mental training. As per the recent studies, all these factors have been found effective in improving executive functions (González-Saiz et al., 2011).

The results also showed that therapeutic community is associated with an increase in specific memories. Persistence in drug abstinence and not using drugs for the duration of several months may improve the cognitive abilities and brain structures of drug users. These cognitive abilities and brain activity improvement play an important role in the specificity of autobiographical memory. Depression disorders share about 47 to 93 percent comorbidity with substance abuse disorder and it has been proven that therapeutic community is effective in the improvement of depression (Carr & Ball, 2014) and depression is the most important reason for autobiographical memory dysfunction (Kong, He, Auerbach, McWhinnie & Xiao, 2015). Thus, one can indirectly conclude that this therapy may be effective in improving autobiographical memory in people with addiction. Depression is the leading cause of autobiographical memory dysfunction. Retrieval of past memories is sometimes painful and people try to suppress memories or avoid recalling such memories along with their negative emotions. This phenomenon is widely observed in depression disorder (Beblo et al., 2012). However, these efforts are associated with counterproductive results. In fact, attempts to suppress these memories strengthen negative memories (Dalgleish & Yiend, 2006). As a result, rumination along with a repetition cycle results in the mandatory recall of negative memories escalation and continuation of depression (Gotlib & Joormann, 2010). Holistic autobiographical memory is considered among the main reasons for addiction relapse and craving (Brorson et al., 2013) through the negative effects it exerts on the ability to solve social problems, planning future programs, emotion regulation (Raes et al., 2005), and depression.

In general, therapeutic community is an effective method wherein the clients receive trainings and services towards stable and long-term drug abstinence. Such trainings and services lead to stepwise and effective change in individuals' attitudes towards different life affairs, including drug use. One of the limitations of this study was the conduct of this study only on one gender due to lack of community treatment centers for women. Other limitations of this study are the unavailability of the follow-up stage and lack of control of comorbid disorders such as depression. Hence, it is suggested that future studies examine the impact of these factors.

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