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## **EFFECTIVENESS OF COGNITIVE REHABILITATION IN REDUCTION OF COGNITIVE DEFICITS (IMPROVING SUSTAINED ATTENTION) OF AMPHETAMINE DEPENDENTS**

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### **ABSTRACT**

The aim of present study was to investigate the effectiveness of Computer-assisted cognitive rehabilitation on reduction of cognitive deficits in error response, delete reply and correct answer in Amphetamine dependence patients. The design study was one participant experimental with multiple line bases. This figure is based on the different (3, 5 and 7) weeks and after finished baseline are included to treatment randomly. Participants divided into 3 groups and included in 3 mentioned baseline. First group has 3 baselines, second group has 5 and third group has 7 baseline and effectiveness of treatment for each group and compare to other groups is calculated and compared. Instruments were Wechsler Memory Scale (WMS), The Knox Cube Imitation Test and Continuous Performance Test. Our results showed that use of computers has led to reduced cognitive deficits (Improving sustained attention) in the patient that dependent on amphetamines.

**Keywords:** *Cognitive Rehabilitation, Cognitive Deficits, Amphetamine Dependents*

### **INTRODUCTION**

The degree of impairment associated with substance use disorders (SUDs) can vary greatly, ranging from comparatively mild to being as severe as that resulting from traumatic brain injury (Bates *et al.*, 2006; Victor & Adams, 1985). There is now ample evidence from multiple lines of researches that chronic abuse or long-standing dependence on psychoactive substances is associated with neuroanatomical changes that appear to give rise to discernable cognitive impairments (e.g., Tanabe *et al.*, 2007; Bolla *et al.*, 2005). Tanabe *et al.*, (2007) suggests that impaired decision-making in chronic substance users may be mediated by abnormalities in ventral medial frontal processing. As a consequence of how it is operationalized and the neuropsychological tests used, prevalence estimates of cognitive impairment among patients with substance use disorders vary widely, ranging from 30% to 80% (Bates & Convit, 1999; Meek *et al.*, 1993; Rourke & Loberg, 1996).

Although comparable programmatic research with individuals who primarily use drugs other than alcohol is less evolved, available evidence reveals that cognitive impairment similar to that observed among alcoholic patients is associated with chronic use of cocaine, heroin, sedative hypnotics, solvents, and multiple drugs in combination (Vik *et al.*, 2004). Neuro imaging studies have shown that methamphetamine abusers showed different abnormalities in their brain function in comparison to normal subjects, these include changes in metabolism in the frontal, temporal and subcortical brain (Volko, 2001). A number of studies have attempted specifically to test cognitive function methamphetamine users; recent studies have documented deficits in learning, delayed reminder, processing speed and memory. Based on the conclusions of a large and growing body of empirical research, the presence of cognitive deficits among substance-abusing patients has important clinical implications. Fundamentally, counseling and other forms of therapy involve both formal and self-directed learning tasks, requiring patients to receive, encode, and integrate new information that is presented during treatment, to organize this information into behavioral plans, and to initiate and execute these plans. Regardless of theoretical orientation, the vast majority of psychosocial treatments for substance use disorders (e.g., 12-step facilitation, motivational interviewing, and cognitive-behavioral therapy) are verbally based interventions that require extensive cognitive processing by patients to facilitate cognitive and behavioral change (Goldman, 1990; Weinstein & Shaffer, 1993).

### **Research Article**

Although individual or group therapy sessions may appear to have a simple and clear presentation, when viewed from a learning perspective, patients are required to utilize a complex set of executive cognitive functions (Fals-Stewart and Lam, 2010). For example, working memory skills are needed that facilitate acquisition and recall of new health information, and initiation and planning skills are needed to organize this information into a behavior change plan.

The newly learned health information and behavior plans must be retrieved and applied at the necessary times outside of treatment toward more healthful behavioral responses, and interference control is needed to discriminate and inhibit irrelevant stimuli, both external and internal, that may interfere with the organization and execution of the behavior plan.

Unfortunately, the presence of cognitive impairment is likely to interfere with this learning and using of new information and, in turn, to be associated with poorer treatment response and long-term outcomes (Fals-Stewart and Lam, 2010). There is growing empirical support for this conceptualization of how the presence of cognitive impairment may affect treatment. More specifically, cognitive impairment among patients with SUDs is associated with poorer treatment response, including (a) lower treatment adherence (Bates *et al.*, 2006), (b) greater frequency of treatment program rule violations (Fals-Stewart, 1993), (c) lower likelihood of successful program completion (Fals-Stewart & Schafer, 1992), (d) slower acquisition of drink refusal skills (Smith & McCrady, 1991), (e) lower levels of treatment engagement (Katz *et al.*, 2005), (f) less readiness to change (Blume *et al.*, 2005), (g) lower self-efficacy (Bates *et al.*, 2006), (h) decreased insight (Horner *et al.*, 1999; Shelton & Parsons, 1987), and (i) increased denial of substance use severity and associated problems (Rinn *et al.*, 2002). Relatedly, several investigations have found that cognitive impairment is associated with poorer substance abuse treatment outcomes, including decreased treatment retention (Aharonovich *et al.*, 2006; Donovan *et al.*, 2001; Fals-Stewart, 1993; Fals-Stewart & Schafer, 1992) and less abstinence from substances of abuse after treatment has ended (Aharonovich *et al.*, 2006).

Given the high prevalence of cognitive impairment among patients with SUDs, as compounded by the link between these impairments and treatment response and outcome, many have recommended that interventions for substance abuse address or otherwise account for patients' cognitive functioning (Fals-Stewart and Lam, 2010). The specific causal role of neurological changes associated with these cognitive impairments, or the role they may play in treatment outcomes, is not yet clear. However, interventions may be able to ameliorate the cognitive impairments to improve treatment outcomes. One approach that appears particularly promising is cognitive rehabilitation (Fals-Stewart and Lam, 2010). Cognitive rehabilitation interventions consist of various exercises designed to enhance such cognitive skills as problem-solving, attention, memory, abstract reasoning. If effective, cognitive rehabilitation could ultimately enhance the ability of patients with SUDs to receive, encode, integrate, retrieve, organize, and use more healthful information garnered during the course of treatment (Fals-Stewart and Lam, 2010). Results from preliminary investigations have supported the positive neuropsychological and therapeutic effects of cognitive rehabilitation for patients with SUDs, although no study to date has been able to test simultaneously the elements of this causal chain model. For example, Fals-Stewart and Lucente (1994) recruited cognitively impaired patients with SUDs (N = 141) from a long-term (i.e., 12-month) residential care facility who were mandated by the criminal justice system to remain in treatment. Those randomly assigned to received computer-assisted cognitive rehabilitation (CACR) showed significantly greater positive acceleration in cognitive performance on neuropsychological tests during the first several months of treatment than residents assigned to control conditions (i.e., computer aided typing, progressive muscle relaxation, or treatments-usual). This is consistent with other studies that have shown that cognitive rehabilitation does accelerate amelioration of cognitive impairments among patients with SUDs (e.g., Goldstein *et al.*, 2005). Computer-assisted cognitive rehabilitation (CACR) has not been widely evaluated to reduce the cognitive impairments associated with amphetamine in patients. However, the aim of present study was to investigate the effectiveness of Computer-assisted cognitive rehabilitation on reduction of cognitive deficits in error response, delete reply and correct answer in Amphetamine dependence patients.

## **Research Article**

### **MATERIALS AND METHODS**

The design study was one participant experimental with multiple line bases. This figure is based on the different (3, 5 and 7) weeks and after finished baseline are included to treatment randomly. Participants divided into 3 groups and included in 3 mentioned baseline. First group has 3 baselines, second group has 5 and third group has 7 baseline and effectiveness of treatment for each group and compare to other groups is calculated and compared. 9 patients were selected based on exit and entry criteria of study. Exit criteria was psychotic and organic disorders and entry criteria was normal IQ and dependent to amphetamine (Methadone). Participants characteristics are as below:

- 1: Male, 25 years old, diploma, self-employment, and 2 years dependent to amphetamine.
- 2: Male, 27 years old, diploma, self-employment, and 3 years dependent to amphetamine.
- 3: Male, 30 years old, Secondary school, self-employment, and 3 years dependent to amphetamine.
- 4: Male, 28 years old, associate degree, self-employment, and 3 years dependent to amphetamine.
- 5: Male, 35 years old, diploma, self-employment, and 2 years dependent to amphetamine.
- 6: Male, 29 years old, associate degree, self-employment, and 3 years dependent to amphetamine.
- 7: Male, 28 years old, diploma, self-employment, and 2 years dependent to amphetamine.
- 8: Male, 32 years old, Secondary school, self-employment, and 2 years dependent to amphetamine.
- 9: Male, 33 years old, diploma, self-employment, and 2 years dependent to amphetamine.

After 3 evaluations at baseline for all participants, 3 individual entered to treatment randomly. While, 6 participants were in baseline stage; after 5 evaluations for dependent variable, 3 individual entered to treatment randomly. And 3 of participants were in baseline stage after 7 evaluations and then entered to treatment. At the end of 5, 10 and 15 session of treatment, Wechsler Clinical Memory scale, Knox Cube Imitation Test and Continuous Performance Test was performed.

#### **Instrument**

**Wechsler Memory Scale (WMS):** s a neuropsychological test designed to measure different memory functions in a person. Anyone ages 16 to 90 is eligible to take this test. The current version is the fourth edition (WMS-IV) which was published in 2009 and which was designed to be used with the WAIS-IV. WMS-IV is made up of seven subtests: Spatial Addition, Symbol Span, Design Memory, General Cognitive Screener, Logical Memory(I & II), Verbal Paired Associates(I & II), and Visual Reproduction(I & II). A person's performance is reported as five Index Scores: Auditory Memory, Visual Memory, Visual Working Memory, Immediate Memory, and Delayed Memory. The WMS-IV also incorporates an optional cognitive exam (Brief Cognitive Status Exam) that helps to assess global cognitive functioning in people with suspected memory deficits or those who have been diagnosed with a various neural, psychiatric and/or developmental disorders. This may include conditions such as dementias or mild learning difficulties. There is clear evidence that the WMS differentiates clinical groups (such as those with dementias or neurological disorders) from those with normal memory functioning and that the primary index scores can distinguish among the memory-impaired clinical groups.

The original WMS was published by Wechsler in 1945 and revised in 1987, 1997, and again in 2009. The WMS-III was normed with the WAIS-III in the United States. This resulted in a representative normative sample of 1,250 adults (between the ages of 16 and 90) who completed both scales. Reliability of this test is 0.62 to 0.82 (Salivan, 2000).

The **Knox Cube Imitation Test (KCIT, or CIT, or KCT):** was developed as a nonverbal test of intelligence developed by Dr. Howard Knox, a medical officer at Ellis Island. It was first published as a pamphlet in 1913, and then in 1914 as a paper in the Journal of the American Medical Association. There were several other tests presented in his paper besides the cube test. In the cube test, 4 black 1" cubes were placed in a row, each cube separated by 4 inches from its neighbors. The test administrators take a smaller cube and taps on the 4 1" cubes in increasing complicated sequences. Performance on the Knox Cube Imitation Test is correlated with both Verbal IQ and Performance IQ.

**The Conners Continuous Performance Test 3rd Edition™ (Conners CPT™)** is a task-oriented computerized assessment of attention-related problems in individuals aged 8 years and older. By indexing

## Research Article

the respondent's performance in areas of inattentiveness, impulsivity, sustained attention, and vigilance. The Conners CPT provides objective information about an individual's performance in attention tasks, complementing information obtained from rating scales. The Conners CPT uses both standardized and raw scores to determine not only the respondent's performance overall but also in four different aspects of attention: Inattentiveness, Impulsivity, Sustained Attention and Vigilance.

Reaction times: This measures the amount of time between the presentation of the stimulus and the client's response.

For evaluation training cognitive functions we used SCHUHFRIED Cogniplus software. Cogniplus is a training system for training cognitive functions. It's Efficient, Multi-media, Motivating; Cogniplus is scientifically based and incorporates up-to-date psychological findings. The content of CogniPlus is closely linked to the Vienna Test System – internationally the most widely used test system for professional psychological assessment.

### The training programs:

#### Attention – **Intensity**

Attention: Alertness

The ALERT training program trains the alertness dimension of attention – the ability to temporarily increase and sustain the intensity of attention.

Attention: Vigilance

The VIG training program trains the attention dimension of vigilance – the ability to sustain attention over a lengthy period of time under monotonous stimulus conditions.

#### Attention – **Selectivity**

DIVID – Attention: **Divided**

The DIVID training program trains divided attention – the ability to perform different tasks simultaneously.

FOCUS – Attention: **Focused**

The FOCUS training program trains focused attention – the ability to respond only to relevant stimuli among a high density of distracting stimuli.

Attention: **Selective**

The SELECT training program trains selective attention – the ability to respond quickly to relevant stimuli and to suppress inappropriate responses.

Data were analysed with eye analyse and Kuhen D method.

## RESULTS AND DISCUSSION

Table 1 show that the group has recorded three basic subjects, baseline over five and seven subjects recorded their variability is low. Variability in scores often observed during treatment and during Follow up created a relatively constant level. When the first group enter to treatment group II and III are still at baseline and first group begins to change when change is not observed in the other two groups. Changes in the levels of all three groups after entering treatment are started. All subjects during treatment with variable of Error response, Delete Reply and Correct answer have shown the greatest increase. Increase the amount of Error response, Delete Reply and Correct answer and the effect size for the index to see relatively large amount (Table 1). The results show the variability and improve patient in of Error response, Delete Reply and correct answer is related to amphetamines.

Effectiveness of rehabilitation with the use of computers has led to reduced cognitive deficits (Improving sustained attention) in the patient that dependent on amphetamines. These results are similar to previous studies (Benedict *et al.*, 1994; Medalia *et al.*, 1998; Pilling *et al.*, 2002, Vik *et al.*, 2004). It is conceivable that the efficacy of rehabilitation to continue to further their shows. The period of treatment in present study was prolonged in compare to previous studies. The 9 participants showed improvements in basic an administrative function that is similar to previous results by other researchers (Bark *et al.*, 2003, Bellucci *et al.*, 2002, Wykes *et al.*, 1999). Planning criteria in the procedure may affect the results of the performance of the subjects. For example, first group had the lowest baseline may be less effective than

**Research Article**

the treatment received, time effectiveness of rehabilitation therapy can Follow up the step (a week after treatment) confirmed.

**Table 1: Effect size, improvement percent and reduction percent of error response, delete reply and correct answer participants**

Participant	Index	Error response	Delete Reply	Correct answer
1	Effect size	0.61	0.85	0.97
	Improvement percent	100	300	1
	Reduction percent	50	75	1
2	Effect size	1.26	1.74	1.76
	Improvement percent	1000	371	8
	Reduction percent	91	79	8
3	Effect size	0.82	1	0.52
	Improvement percent	200	1	1
	Reduction percent	67	1	1
4	Effect size	0.62	0.12	0.57
	Improvement percent	140	20	0.1
	Reduction percent	58	17	0.1
5	Effect size	1.17	0.49	1.24
	Improvement percent	740	8	2
	Reduction percent	88	44	2
6	Effect size	0.12	0.22	0.87
	Improvement percent	440	20	1
	Reduction percent	81	17	1
7	Effect size	1.59	1.04	1.18
	Improvement percent	842	131	3
	Reduction percent	89	56	3
8	Effect size	0.84	0.79	1.01
	Improvement percent	200	200	1
	Reduction percent	67	100	1
9	Effect size	1.46	0.67	1.42
	Improvement percent	-	-	1
	Reduction percent	100	100	1

Reduced scale score of 9 participants in the continuous operation of the reaction time of the baseline to end of treatment sessions showed the effect of reducing defects in cognitive rehabilitation therapy (to improve response time). In connection with the continuation of treatment, results obtained from the subjects' scores on the Wechsler Memory Scale-term direct and reverse, seat cubes and scale continuous operation (cpt) at follow-up showed that a week after the end of treatment sessions development of cognitive impairment subjects did not return.

According to the findings of the study, subjects improvement in reaction time and working memory and consistent of results with previous research, cognitive rehabilitation can be said that the computer was able to reduce the cognitive deficits of patients dependent on amphetamines. Lack of follow-up interval of more than a week, the lack of research in relation to those of amphetamine, Czech withheld other cognitive deficits in patients dependent on amphetamines, Czech withheld treatment (efficacy of rehabilitation) with other treatment methods, lack of homogeneity characteristics of participants, the lack of other instruments to measure cognitive deficits, lack of tools to assess the clinical significance of the limitations of this study are considered. Further research is recommended to conduct a similar investigation in relation to the research and conclusions are more accurate in this field, more research in this area is conduct with large sample size.

## Research Article

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### Research Article

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**Research Article**

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