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Self-regulation and Set-shifting in Alcohol Dependence Syndrome

KEYWORDS: Self-regulation, Set shifting, Alcohol severity, Relapse

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ABSTRACT *Alcohol Dependence Syndrome (ADS) is a chronic disorder which impairs complex range of executive functions among which self-regulation and set shifting is necessary for change in alcohol dependent individuals. Aim of the study was to determine the significant predictor of alcohol relapse among alcohol severity, set shifting and self-regulation. Cross-sectional descriptive design was used and 46 patients and 37 normal controls were recruited for the study. The findings show that the ADS group performed more poorly than the normal group on the tests of set shifting and self-regulation. Significant intercorrelations were found among self-regulation, set shifting, alcohol severity, and relapse. Alcohol severity was found to be the most significant predictor for relapse among the three variables studied. Individuals with ADS show poor self-regulatory behaviors and impaired set shifting, indicating significant role in alcohol severity and number of relapses.*

Introduction

Alcohol dependence is primarily a chronic disease that is progressive and fatal in nature. Alcohol dependence is not just a symptom due to a physical or mental condition, instead it itself is a disease condition like any other disease. Alcohol Dependence Syndrome (ADS) has very clear recognizable set of symptoms. World Health Organization in International Classification for Disorders (ICD-10) (WHO, 1993) and American Psychiatric Association in Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (APA, 1994) has outlined the diagnostic criteria for ADS.

One of the most remarkable aspects of this disease is the chronic relapses that can occur after many years of abstinence, and rates of recurrence are high in patients who are highly motivated to abstain too (Lido, 2011).They have impaired control over drinking as they are consistently unable to limit the number of occasions when alcohol is used or the amount of alcohol ingested on those occasions. Alcohol is predicted to increase dysfunctional behavior in situations that require self control. The behavioral consequences of intoxication hold that alcohol impairs psychological processes central to self-regulation (Baumeister and Vohs, 2004).

Self-regulation encompasses any efforts by the human self to alter any of its own inner states or responses. Self-regulation can be described in terms of people regulating their thoughts, emotions, impulses or appetites, and task performances. The executive function of the self refers to its active, intentional aspects (Baumeister, 1998; Gazzaniga, Ivry and Mangun, 1998) and may be thought of as that part of the self which is ultimately responsible for the actions of the individual. Studies using a variety of methodologies suggest that individuals with weak self regulatory skills consume larger amounts of alcohol than do individuals with strong self regulatory skills. Self-regulation failures set up future failures to self-regulate, and ultimately lead to the chronic relapsing disorder considered as addiction (Baumeister, Heatherton and Tice, 1994)

Self-regulation is one of the self's major executive functions. Executive function deficits are among the alcohol-related cognitive impairments that are most likely to affect rehabilitation success (Ihara, Berrios and London, 2000). Individuals with chronic alcohol abuse show impairments in several cognitive functions. Individuals with alcoholism are reported to be impaired on tests of functions related to the frontal lobes (Dao-Castellana et al. 1998). Frontal lobe deficits tend to interfere with relapse prevention strategies directed at the rehabilitation of alcohol-dependent patients after the detoxification phase is over (Tapert, Ozyurt and Myers, 2004). Severe chronic use of alcohol has been consistently associated with neuropsychological impairments with respect to cognitive flexibility, problem solving, decision making, risky behavior and further aspects of cognitive function (Noel, Bechara and Dan, 2007; Glass,Buu and Adams, 2009). The frontal lobes are known to play a key role in executive functioning and therefore the ability to shift set (Shallice, 1988).

Set shifting is an integral component of cognitive and behavioral flexibility. It involves the ability to adapt behavior or thoughts in line with changing demands of the situation or environment, by switching attention between different topics. Set shifting is one of the executive functions (Lezak, Howieson and Loring, 2004). It is the ability to adapt responses to a changing environment. Set shifting ability regulates attention, thought, speech, emotion, and social behavior. It requires cognitive flexibility both in formation of a mental set and in the subsequent shifting of the set. Mental set can be considered a precursor to habit. The capacity to adapt mental set to the environment is essential for regulating behavior.

Poor self regulation skills may regulate the duration of abstinence period. Self regulation skills have profound influence on the relapse of ADS and executive functional deficits are present due to intoxication. According to the Marlatt and Gordon (1985) model of relapse prevention, following interventions to reduce drinking, those who perceive a lower efficacy to refuse alcohol across a variety of situations are more likely to experience relapse.

The capacity to adapt mental set to the environment, i.e. set shifting is essential for regulating behavior. As the rate of relapse is increasing alarmingly, there is an urgent need to probe into other dimensions that regulate behavior and the cognitive components that may influence the regulation of behavior. The present study aims to determine the significant predictors of alcohol relapse among alcohol severity, set shifting and self- regulation. Study hypotheses were: individuals with alcohol dependence will display more impairment in set shifting and self-regulation compared to normal group; there is a relationship between self-regulation behavior and set shifting; and the degree of impairment in self-regulation, set shifting & alcohol severity will determine the relapse rate.

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Method

Participants

The subjects meeting the criteria of ICD-10 for ADS were recruited as the study group from the patients attending OPD or ward of Psychiatry Department of Kasturba Medical College, Manipal, Dr. A V Baliga Hospital, and District Government Hospital, Udupi, Karnataka. The samples for the study consisted of two groups, namely the ADS group and the normal control group. Purposive sampling was employed to select the samples. The study was a cross-sectional descriptive design. The samples consisted of 46 samples in the ADS group and age & education matched 37 subjects were included in the normal control group. The study period was from December, 2010 to April, 2011. Study subjects were recruited based on the following inclusion and exclusion criteria: Age between 18 and 60 years; individuals obtaining a score of 3 or more in The Short Michigan Alcoholism Screening Test (SMAST); patients diagnosed as having ADS without any comorbid psychiatric disorder according to ICD-10 criteria; able to read English or Kannada; score less than 24 on Mini-Mental State Examination; patients currently in alcohol withdrawal related delirium.

Measures

The Self-Regulation Questionnaire (SRQ) (Brown, Miller and Lawendowski, 1999)

The Self-Regulation Questionnaire was administered to get the total score of self-regulation of adults with Alcohol Dependent Syndrome and the normal controls. The scale consists of 63 items and is answered on a 5-point Likert scale. Score above 239 indicates High (intact) self-regulation capacity, 214-238 Intermediate (moderate) self-regulation capacity and Less than 213 Low (impaired) self-regulation capacity. Test-retest reliability for the total SRQ score was high ($r = .94$, $p < .0001$). Internal consistency of the scale was also quite high (" = .91), consistent with the idea that its items contain much redundancy.

The Alcohol Use Disorders Identification Test: Interview Version (AUDIT) (Babor, de la Fuente, Saunders and Grant, 1989)

The Alcohol Use Disorders Identification Test was administered to the experimental group to identify the severity of alcohol dependence. Total scores of 8 or more are recommended as indicators of hazardous and harmful alcohol use, as well as possible alcohol dependence. Alcohol Use Disorders Identification Test (AUDIT) scores in the range of 8-15 represented a medium level of alcohol problems whereas scores of 16 and above represented a high level of alcohol problems (Miller, Zweben, DiClemente, and Rychtarik 1992). The results indicate high internal consistency, suggesting that the Alcohol Use Disorders Identification Test is measuring a single construct in a reliable fashion. A test-retest reliability study indicated high reliability (r =.86) (Sinclair, McRee and Babor, 1992).

Trail Making Test B-TMTB (Reitan, 1958)

It measures speed for visual scanning, attention, cognitive flexibility, set-shifting and motor function. This test comprises of two trials. In the first (trail making task A) the subject is presented with a sheet of paper on which are scattered 25 printed circles, each enclosing one of the numbers from 1 to 25. The subject is required to join the circles in a numerical order as quickly as possible. In the second (Trail Making B), the subject is presented with a similar sheet of paper on which are scattered 25 circles enclosing the numbers 1 to 13 and letters A to I, and is required to join them in the order 1-A-2-B etc., as quickly as possible.

Wisconsin Card Sorting Test –WCST **(Grand and Berg, 1948)** This test measures the ability to form abstract concepts, to shift and maintain set, and utilize feedback. It was developed by Berg and Grant (Grant and Berg, 1948) to assess abstraction ability and ability to shift cognitive strategies in response to changing environmental contingencies. The test consists of 128 cards and in addition to it, four stimulus cards, placed in front of the subject; the first with a red triangle, the second with two green stars, the third with three yellow crosses, the fourth with four blue circles on them. The subject has to match each card with any one of the four stimulus cards during each trial. The subject is told only whether each response is right or wrong and is never told the correct sorting principle. The subject has to guess the concept based on it and continue with the test. He or she has to perceive a change in the concept when the next sorting principle is introduced. The test is terminated when after the subject attains all the 6 concepts or after all the 128 cards have been used. The first principle of matching is by color, followed by form, and finally by number. Then the same sequence is repeated again.

Procedure

Institutional Ethics Committee clearance was taken before initiating the data collection. The rapport was established and informed consent was taken after explaining the nature and procedure of the study. After the written consent was obtained, demographic information was collected and screening tools were administered. AUDIT, SRQ, Trail making, and WCST were administered to both ADS and normal group. Adequate rest/pause was given during test administration. The data was analyzed using the computerized Statistical Package for Social Sciences.

Results

Participants Demographics

Participant ranged from 26 to 40 years of age. Mean age of the ADS group was 33.73 (SD = 7.4) and normal group was 33.78 (SD = 7.6). There was no significant difference between study and control group on age. 71.1% of the sample belonged to the rural area and only 29.9% belonged to the urban area. 72.3% of the sample was school educated and only 27.7% college educated.

Self- regulation and Set Shifting

ADS is closely associated with two major dimensions such as self-regulation and executive function deficit. Self-regulation was one of the major variables in the present study. Table 1 shows the comparison between ADS and normal group on self-regulation. There was significant difference observed between the two groups with regard to self- regulation $t (81) = -22.74$, $P < 0.001$. ADS group shows poor ability in regulating or controlling their behavior, which indicates that self-regulation impairment is significantly high in ADS group. As table 1 shows poor set shifting was observed in ADS group. Set shifting was measured using WCST and TMT B, which are executive function measures. On the total errors category of WCST, ADS group committed more errors compared to normal $t (81) = 9.71$, $P < 0.001$. Similarly, the perseverative errors in WCST were more in ADS group compared to normal $t (81) = 11.68$, $P < 0.001$. ADS group committed more errors in TMT B measures as indicated by the values $t (81) = 2$, $P < 001$.

Table 1 Comparison between ADS & Normal group on Self-regulation, and Set shifting

Measures	Group	Mean (SD)	t	p value
Self -Regulation	ADS	173 (17)	-22.74***	<.001
	Normal	262 (18)		
WCST percent total errors (WCST-TE)	ADS	45.43 (7.92)	9.71***	<.001
	Normal	30.41(5.65)		
WCST percent perseverative errors (WCST-PE)	ADS	30.17 (8.13)	11.68***	**<.001**
	Normal	12.43 (4.89)		
TMTB Error	ADS	0.33 (0.59)	2.0***	<.001
	Normal	0.11(0.31)		

*** P< .001

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Table 2 Mean, Standard Deviations, and Intercorrelations for Relapse and Predictors (N= 46)

Variable		Mean (SD)	Self-regulation	WCST-T errors	WCST-P errors	TMTB errors	Alcohol severity
	Relapse	3.15 (1.09)	-.54**	.53**	.50**	.46**	.67**
Predictors variables	Self-regulation	1.73 (17.49)		-.87**	-.89**	-.93**	-.83**
	WCST-TE	45.43 (7.92)			.94**	.86**	.69**
	WCST-PE	30.17 (8.13)		.		.86**	.68**
	TMTB time	139.72 (24.68)					.68**
	Alcohol severity	19.5 (4.17)					1

** P < 0.01

As table 2 shows, self-regulation, set shifting, and alcohol severity were significantly correlated with relapse (P < 0.01). It indicates that self-regulation set shifting, and alcohol severity play significant roles in determining the relapse in an individual. Significant intercorrelations among the variables indicate the importance of those variables, which modulate various impairments in the person diagnosed with ADS. Table 3 displays multiple regression analysis for self-regulation, set shifting, and alcohol severity predicting relapse.

Table 3 Multiple regression analysis for self-regulation, set shifting, and alcohol severity predicting relapse (N=46)

Variable	B	SEB	β
Self-regulation	.01	.02	.16
Set shifting WCST-TE	.04	.04	.29
WCST-PE	-.002	.03	-.02
TMTB time	.001	.009	.02
Alcohol severity	.19	.06	.71**

R^2 = 46.7; F (5, 40) = 7.01, ** P< 0.01

As reported in table 3, alcohol severity significantly predicted the relapse. It helps us to understand the alcohol relapse in different perspective. However, other variables such as self-regulation and set shifting also contribute to the prediction equation. 40 % of variance can be predicted from the independent variables.

Discussion

The present study made an attempt to assess the role of self-regulation set shifting, and alcohol severity in adults with ADS and controls. The objectives of the present study were to compare the self regulation and set shifting of ADS and that in normal controls. Determining the significant predictors of relapse among self-regulation, set shifting, alcohol severity was the second objective of the study.

There was a significant difference observed between the self-regulation of the ADS group and the normal group. The findings clearly indicate that individuals with alcohol dependence have low self-regulation compared to the normal group. The low self-regulation in alcohol dependent individuals can be due to the intoxication which impairs the cognitive processes central to self-regulation. Study by Luria (1966) has supporting evidence that prefrontal areas are responsible for the execution and regulation of behavior. Dao-Castellana et al. (1998) found that individuals with alcohol dependency are reported to be impaired on tests of functions related to the frontal lobes. Present study findings are consistent with the existing literature. Wills and Stoolmiller (2002) had found that lower levels of self regulation are related to increased substance use. Baumeister and Bushman (2008) found that poor self regulation functions as a risk factor for increased substance use and insufficient self regulation leads to abuse of alcohol.

The study findings of set shifting tasks show that the ADS group is significantly impaired on executive functions tasks. Poor ability in set shifting was confirmed through these tasks. Joyce and Robbins, (1991) found that alcohol dependent individuals make more errors in the WCST compared to control participants. Study by Nirmal, Sanjeev and Daya, (2006) reveals that alcohol-dependent group required a significantly longer time to complete part B of the TMT. A novel aspect of the present research was to explore the impact of set shifting deficit on alcohol relapse. Set shifting ability which is a cognitive ability is included under the executive functions carried out by the prefrontal cortex. Monchi, Petrides and Petre, (2001) has found that dorsolateral prefrontal areas (DLPF; BA 9/46) become active in response to both shift and non-shift cues during WCST performance. Luks, Simpson, Feiwell and Miller, (2002) have reported similar findings of activation of dorsolateral prefrontal areas during performance of other task-switching paradigms. Poor set shifting ability can be attributed to the impairment of cognitive abilities especially deficits in frontal lobe. Study by Zinn, Stein and Swartzwelder, (2004) gives supporting evidence that heavy alcohol consumption is known to impair abstract thinking, cognitive flexibility and persistence, and inhibition of competing responses.

Set shifting scores (WCST– TE & WCST- PE) has a positive correlation with alcohol severity and number of relapse (r = .696 & .676, P < 0.01). High set shifting scores indicate more perseverative errors and more time in task switching. The more perseverative responses in individuals with alcohol dependence can lead them to perseverate in the drinking habit, losing control and eventually leading to increased alcohol severity. Since set shifting ability demands the ability to change the mental set, alcohol dependent individuals who have low set shifting ability find it difficult to change the mental set during abstinence and end up relapsing. This is consistent with the existing literature. Study by Parsons (1998) revealed that Alcohol-dependent subjects tend to show more errors in the tasks and take more time to complete some activities. The findings of present study propose that low set shifting ability in alcohol dependent individuals can lead to more severity of alcohol and more number of relapse.

We also observed that self-regulation and set shifting ability are inter related (r = -.81 & -.73, P < 0.01) both having profound influence in alcoholism. Set shifting is a major component of the executive function (Miyake et al. 2000). Self regulation is considered as self's major executive function. Both self regulation and set shifting are affected by impairment in frontal lobe functions which can be due to intoxication in alcohol dependent individuals. (Malloy, Bihrle, Duffy and Cimino, 1993) found that prefrontal cortex have a key role in regulation and maintenance of set and ongoing behavior. Set shifting ability is necessary to shift the mind quickly and to adapt to diverse situations while simultaneously repressing inappropriate behaviors. This capacity to adapt mental set to the environment is essential for regulating behavior (Spreen and Strauss, 1998). The present study discloses that poor set shifting has a profound influence on the self regulation.

The present study specifies that, individuals with high self-regulation show low severity of alcohol consumption and less number of relapses. This suggests that low self-regulation can increase alcohol severity as well as the number of relapses. Low self regulation can lead to the inability to regulate the behavior, especially with alcohol dependent individuals, the ability to stop or rather control drinking. This will eventually lead to increase in alcohol severity and more number of relapses. In addition, alcohol severity was a significant predictor of relapse in regression model along with other variables (t [46] = 3.35, P < 0.01, β = .71). There is consistent literature supporting the findings of the present study. Study by Hodgson, Rankine and Stockwell, (1979) suggest that one drink does not lead inevitably to uncontrolled drinking, rather it is the inability to stop drinking once started, leads to uncontrolled drinking. Research has shown that severity of dependence affects the ability to stop drinking after the first drink.

Study by Miller (1991) has found that impairment of execu-

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tive functions in alcohol dependent individuals has been associated with higher rates of relapse. Our study proposes that alcohol dependent individuals with more severity and more number of relapses have low self regulation.

The present study identifies the relationship between self regulation and set shifting in alcohol dependence syndrome. Subjects with alcohol dependence are found to have low self regulation and low set shifting ability compared to normal. As the self regulation increases, it is found that there is an increase in set shifting ability. Self regulation and set shifting were found to have a profound influence on the alcohol severity and the number of relapses. The findings of the present study gives insight into the need for paying attention to self regulation and set shifting in the treatment for alcohol dependence syndrome. Self regulation enhancement strategies and cognitive training for set shifting, if included in the management of alcohol dependence syndrome, could help to prevent the relapse of this chronic disorder.

Strengths of the current study: researchers ensured that the study subjects were screened by standardized instruments and independently evaluated by psychiatrist/clinical psychologist to exclude ADS with comorbid psychiatric disorder. Comparison with non- alcoholic control group increased the validity of results. Confounding effects were minimized as the study group was matched for age and education with the normal control group. Limitations of the study include limited generalizabilty of results due to small sample size and non assessment of certain dimensions like family, sociological and environmental factors.

Conclusion

In conclusion, the present study was able to establish a robust relationship between self-regulation and set shifting. This suggests that the degree self regulation and set shifting has a profound influence in Alcohol Dependence Syndrome. Thus alcohol dependent individuals show poor self-regulatory behaviors and set shifting with respect to control various alcohol related cues from the environment and from within the individual. It has significant role in determining alcohol severity and the number of relapses.

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