

Cognitive Disengagement Syndrome and Executive Functions Among Adolescents With Autism

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ABSTRACT

Background : Cognitive Disengagement syndrome (CDS) refers to the set of behavioral and cognitive symptoms in which behavioral symptoms are manifested as motor hypoactivity such as low levels of energy, lethargic, tiredness and sluggish movements whereas cognitive disengagement symptoms include day dreaming, preoccupation, staring blankly, getting lost in their own thoughts and slow processing. CDS has impact in other neurodevelopmental disorders and exhibit marked impairment in executive functioning. The aim of the study is to explore Cognitive Disengagement Syndrome among Adolescents with Mild autism and to understand the differences in Executive functioning among children with and without CDS.

Method: The purposive sample comprised of 43 adolescents both male and female age ranges from 10-16 years (M= 12.37) with ASD (already diagnosed by licensed Clinical Psychologist/pediatrician/psychiatrist) having below average and average intellectual functioning. They were assessed for Intellectual functioning, severity of autism and executive functioning in the domains of working memory, Inhibition, Attention, Planning and indicator of CDS scale.

Result: The results of the study showed that 76.7% of sample had CDS among adolescents with Mild Autism. There exist significant deficits in the areas of working memory, inhibition and planning among children with Mild autism.

Conclusion: There are significant differences in the cognitive domain of Autism between group with CDS and without CDS. The results of this study emphasis the need for new strategies to manage individuals with CDS in academic setting and at home. Hence identifying CDS paves way for primary prevention.

Key words: Cognitive Disengagement Syndrome, Autism Spectrum Disorder, Executive functions.

1. Introduction

Autism spectrum disorder (ASD) is a complex neurodevelopmental condition characterized by qualitative impairments in social interaction and communication, as well as restricted and repetitive patterns of behaviour, interests, and activities. It is estimated that over two million individuals may be affected by ASD in India^[1]. Alongside these core symptoms, individuals with ASD often experience additional challenges, such as sensory and cognitive impairments. These cognitive deficits may include problems with executive functioning, spatial reasoning, working memory, and episodic memory^[2]. Studies have reported executive function (EF) deficits in children with autism spectrum disorder (ASD), particularly in working memory, inhibitory control, and cognitive flexibility. The behavioral symptoms and difficulties in social and emotional skills observed in autism may be largely due to the close relationship these skills have with executive functions.

The term CDS was initially referred as Sluggish Cognitive tempo (SCT) and it was replaced as Cognitive Disengagement Syndrome^[3]. CDS refers to cluster of behaviors that include cognitive disengagement and motor hypoactivity. The former is reflected as apathy, slow processing, excessive day dreaming, mental foggy and the latter is reflected as hypoactivity, sluggishness and sleepiness^[4]. Prevalence rate of SCT in autism ranges from 30%^[5] to 37%^[6]. The prevalence of CDS was 22% during preschool, 29% during early childhood, 41% during late childhood, and 50% during adolescence^[7,8] indicating the importance of studying CDS during the adolescence phase.

Although the origin of CDS has been derived from ADHD, several research studies have identified CDS as a distinct factor by identifying it's symptomatology, neuropsychological functioning and meta cognitive deficits^[9]. CDS exhibits unique symptom dimensions and different clinical correlations related to executive function deficits, psychosocial impairments, and professional diagnoses. CDS symptoms has more social impairments such as social withdrawal, losing one's train of thoughts, difficulty in detecting and grasping social cues. In addition to social impairments, there were executive function deficits such as working memory, self-organisation, allocation of resources, managing one's own time effectively, and intrinsic motivation^[10]. Studies have found that SCT was associated with reduced activity in the Left superior Parietal lobe which is concerned with attention orientation network^[11]. Individuals with ASD also shows deficits in attention such as orienting, sustaining and shifting of attention The core symptoms of ASD include deficits in the area of social

communication, lack of reciprocity, difficulty to understand and adjust to the social norms. This symptom was in line with CDS symptoms when identifying CDS only among typical children who exhibited social impairments [12]. The comorbidity of CDS in ASD was 37% [13]. There is a significant association between ASD and CDS symptoms when the covariates such as Intellectual functioning and ADHD symptoms are controlled [6,13]. These indicated that the need to identify CDS in individuals with ASD due to the impact it poses which in turn aids in effective implementation of intervention strategies such as teaching and implementing flexible instruction and learning styles at home and in the school setting.

Methodology

After getting approval by the Institute's Ethical Committee, the data was collected at the outpatient of the Institution in a span of seven months. Participants were adolescent already diagnosed as ASD by a Clinical Psychologist using purposive sampling method. The aim of the study is to explore Cognitive Disengagement Syndrome in Adolescents with Mild autism and to understand the differences in EF among children with and without CDS. The inclusion criteria included adolescents of both male and female aged from 10 years to 16 years with Mild autism who have below average, average or above average intellectual functioning in SPM. Adolescents with autism who scored grade V, intellectually impaired in SPM with co-morbidity of any physical or mental illness, who has history of seizure were excluded from the study.

Parents of the participants were first presented with information about the study, after getting informed consent from their parents, demographic information was collected. The current severity of Autism was assessed by using Indian Scale of Assessment of Autism (ISAA) and level of intellectual functioning was assessed using Standard Progressive Matrices. Further, Sluggish Cognitive Tempo Scale developed by Penny et al., (2009) was administered to the parent by the researcher. Further, to assess the EF Colour Trail test, Stroop test, Letter Number sequencing, digit span and Porteus maze were administered individually to the participants. These tests took 30 minutes in total.

Results

Table 1 shows the descriptive statistics of socio-demographic variables

Variables	Participants demographics		
Age	10 years ^a	14	32.6%
	11 years ^a	4	9.3 %
	12 years ^a	5	11.6 %
	13 years ^a	4	9.3%
	14 years ^a	8	18.6 %
	15 years ^a	4	9.3 %
	16 years ^a	4	9.3 %
	Age ^b	12.37	2.127
Gender	Male ^a	37	86%
	Female ^a	6	14%
Intellectual Functioning	Average Intellectual functioning ^a	25	58.1%
	Above average Intellectual functioning ^a	1	2.3%
	Definitely below average Intellectual functioning ^a	17	39.5 %

^a -expressed as Frequency and percentage; ^b -expressed as Mean and Standard deviation

Table 2 show the Frequency of EF scores among adolescents with Mild Autism

Variables			Frequency	Percent (Expressed in %)
CDS		High CDS	33	76.7
		Low CDS	10	23.3
Focussed attention		Impaired	19	44.2
		Intact	24	55.8
Higher Focussed attention		Impaired	14	32.6
		Intact	29	67.4
Working memory		Impaired LNS	30	69.8
		Intact LNS	13	30.2
		Impaired DB	38	88.4
		Intact DB	5	11.6
Inhibition	Reading words	Impaired	16	37.2
		Borderline	12	27.9
		Intact	15	34.9
	Reading colour	Impaired	19	44.2
		Borderline	16	37.2
		Intact	8	18.6
	Colour word	Impaired	21	48.8
		Borderline	14	32.6
		Intact	8	18.6
Planning		Impaired	42	97.67
		Intact	1	2.3

The cut off scores used in the study was 1.5 (as given by the author of the scale Penny et al., in 2009) above which is considered as High and below 1.5 is considered as low. The percentage of participants obtaining high scores on CDS was 76.7% and percentage of participants obtaining low scores on CDS was 23%. Seventy percentage of participants have impaired Working memory in Letter Number Sequencing sub test and 30% of participants have intact Working memory in Letter Number Sequencing sub test. Eighty-eight percentage of participants have impaired Working memory in Digit span sub test and 12% of participants have intact Working memory in Digit span sub test. Forty-four percentage of sample have scored below the percentile indicating impairment in focused attention and 56 % of sample have scored above the 95th percentile indicating intact focused attention. Thirty-three percentage of sample have scored below the percentile indicating Impairment in higher focused attention and 67% of sample have scored below the percentile indicating Intact higher focused attention. Ninety-eight percentage of sample have impaired Planning skills and two percentage of sample have intact planning skills.

Table 3 shows the Independent Sample t-test based on symptoms of Autism

Variables		t	Df	Sig. (2-tailed)	Mean Difference
Social relationship and reciprocity	Equal variances assumed	-1.034	41	.307	-1.673
Emotional responsiveness	Equal variances assumed	.107	41	.915	.088
Speech- Language and communication	Equal variances assumed	.803	41	.427	1.097
Behavior patterns	Equal variances assumed	.323	41	.748	.355
Sensory Aspects	Equal variances assumed	-1.264	41	.213	-.812
Cognitive component	Equal variances not assumed	3.613	22.202	.002	2.530

The independent sample t test analysis showed that there were significant differences on social relationship and reciprocity, emotional responsiveness, speech-language and communication, behaviour patterns, and sensory aspects among adolescents having autism with CDS and without CDS. There is a significant difference in the cognitive component $t(22.202) = 3.613$, $p < 0.01$ among adolescents having autism with CDS and without CDS.

Table 4 shows the Independent Sample t-test for EP

Variables			t	df	Sig. (2-tailed)	Mean Difference
Working memory	Letter Number	Equal variances	.705	41	.485	1.742
	sequencing	assumed				
	Digit backwards	Equal variances	.086	41	.932	.188
		assumed				
Focussed attention	CTT -IA	Equal variances	-1.789	41	.081	-45.312
		assumed				
Higher focussed attention	CTT-B	Equal variances	-1.096	41	.279	-37.009
		assumed				
Inhibition	Stroop W	Equal variances	.113	41	.911	.797
		assumed				
	Stroop-C	Equal variances	-.623	41	.537	-3.494
		assumed				
	Stroop-CW	Equal variances	1.152	41	.256	3.909
		assumed				
Planning	Maze	Equal variances	2.169	41	.048	1.352
		not assumed				

The independent sample t test analysis showed that there were no significant differences on working memory, focussed attention and Inhibition among adolescents having autism with CDS and without CDS. There is a significant difference in the planning ability $t(41) = 2.169$, $p < 0.05$ among adolescents having autism with CDS and without CDS.

Table 5 shows the descriptive statistics for Executive Functions based on the grouping variable – high CDS and low CDS

Cut off variables			N	Mean	Std. Deviation	Std. Error
Working Memory	Scaled DB	High CDS	33	4.45	3.866	.673
		Low CDS	10	4.50	3.689	1.167
	LNS	High CDS	33	8.24	6.562	1.142
		Low CDS	10	6.50	7.792	2.464
	Score	High CDS	33	11.79	5.846	1.018
		Low CDS	10	11.60	6.769	2.141
	Scaled LNS	High CDS	33	3.21	2.848	.496
		Low CDS	10	2.20	2.440	.772
	Sum of scaled scores	High CDS	33	7.67	5.743	1.000
		Low CDS	10	6.70	5.229	1.654
Focussed attention	CTT -IA	High CDS	33	115.79	66.772	11.623
		Low CDS	10	161.10	81.047	25.629
Higher Focussed attention	CTT-B	High CDS	33	186.09	78.932	13.740
		Low CDS	10	223.10	132.997	42.057
Inhibition	Stroop W	High CDS	33	48.70	17.114	2.979
		Low CDS	10	47.90	26.689	8.440
	Stroop-C	High CDS	33	35.61	14.186	2.469
		Low CDS	10	39.10	19.621	6.205
	Stroop-CW	High CDS	33	22.91	9.224	1.606
		Low CDS	10	19.00	9.989	3.159
Planning	MAZE	High CDS	33	7.15	1.642	.286

From the descriptive statistic (Table V) it was observed that adolescents having CDS had lower mean age in planning (9.03 ± 2.543) than adolescents not having CDS (6.50 ± 1.71)

Discussion

The results of the study showed that 76.7% of sample has CDS among adolescents with Mild Autism. Prior studies indicate that the prevalence of CDS was 50% during adolescence [8]. Presence of CDS as a comorbidity in the diagnosis of ASD would result more impairment in social and academic domains and poses heightened risk for internalizing disorders [10].

The results of the study further revealed that are no deficits in the areas of Executive functioning among adolescents with ASD. The results obtained were contradictory to the previous studies which have indicated deficits in focused attention among children with autism. The current study results did not support the evidence, the reason could be attributed to that most of the children had intact intellectual functioning. The similar finding has been revealed in previous studies [14]. In the previous study the author have explained that intellectual functioning could act as a protective factor against developing clinically significant impairment in focused attention [14]. Up to 30% of sample only showed impairment in higher focused attention which could be due to failure of the test to produce significant level of task difficulty and the current findings does not necessarily indicate intact higher focused attention.

This study also highlights that 69% to 88% of sample exhibited impairment in Working memory which is in line with the previous studies [15,16,17,18]. As children with autism have deficits in communication, the deficits in WM could be attributed to the verbal nature of the test. There is a direct relationship between working memory deficits and adaptive functioning [18]. Deficits in WM results in difficulty in everyday functioning such as performing multiple tasks, having a track of things that one needs to be done and task completion [19]. Further, it

was also found that 97.67% of the sample exhibited deficits in the area of Planning. These results are in line with the previous studies^[20]. In addition, review of literature reveals that deficits in the area of Executive function especially planning is linked to deficits in theory of mind which is manifested in the form of impaired ability to explain the individuals' affective states^[21]. Planning is also reflected in the areas of academic performance such as timely initiation and completion of the task, planning and executing the study timings, prioritizing and allocating resources accordingly and not getting stuck if the plan did not go in the anticipated manner. One of the features of CDS include initiating the tasks and timely completion of assignments, this could be due to deficits in the area of planning^[22]. The planning deficits was more seen among adolescent children with autism because of the increased expectation from the parents and increased environmental demands from school and home as their chronological age increase^[23,24]. In this study, maze was used to measure planning ability. During the assessment of maze task, some of the children got stuck in the blind alley in the first trail and when given second trail they impulsively traced the same route and redrew in the same path. This reflects the individuals with deficits in planning and difficulty in visualising the path visuo-spatially^[24]. There is a significant difference in the planning ability $t = 2.169$, $p < 0.05$ among adolescents having autism with CDS and without CDS. However, the effect size was not calculated.

This study highlights the need for identifying CDS and need to tailorize the interventions strategies accordingly in various areas of functioning such as home, school and community.

The study posits certain limitations such as it cannot be generalized to other non-clinical and clinical group of population, gender difference and other cognitive functions such as visual, spatial WM, sustained attention, and cognitive flexibility which can also be studied in detail to understand their impact on CDS among children with ASD.

The results of this study emphasis the need for new strategies to manage individuals with CDS in academic setting and at home. The impairment in planning domain is very significant in the study. Planning is essential for everyday activities also in selecting their career after their formal education. Assessing, Acknowledging and appreciating the strengths in ASD is more essential for development of self-esteem and quality of life.

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