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Efficacy of Behavioural and Multimodal Interventions to Reduce ADHD Symptoms in Childhood

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Attention Deficit Hyperactivity Disorder (ADHD) is one of the prevalent neurodevelopmental and heterogenous disorder. The present study focuses on developing a structured and holistic session-wise management guidelines and find out the pre-post treatment change of both behavioural and multimodal treatment paradigms for ADHD symptoms severity. 20 families participated in the study. The children were selected according to DSM-5 ADHD Combined Type criteria. Half of the participants received behavioural intervention and the others received multimodal intervention. In behavioural intervention the focus was on application of behavioural principles and strategies for symptom reduction. This modality of treatment aims to change the present environment to modify behaviour. Whereas multimodal paradigm aims to address the ADHD heterogeneity by incorporating combined therapeutic principles for symptom reduction. The pre-post treatment change was statistically analysed to determine the treatment efficacy. Statistical analysis using Wilcoxon-Signed Rank Test revealed both treatment modalities are effective in symptom reduction. Though both the treatment modalities were found to be effective, multimodal treatment modality showed more improvement with respect to ADHD core symptoms reduction.

Keywords: ADHD, behavioural intervention, multimodal intervention

Attention Deficit Hyperactivity Disorder (ADHD) is an early onset neurodevelopmental disorder manifested by triad core diagnostic presentations in the areas of sustaining attention, activity levels and impulsiveness. In India, ADHD is considered as a school confined behavioural condition; the widely held referrals were related to academic under performance (Wilcox et al. 2007). In India, the research on ADHD is in its blossoming stage. Parents of ADHD children mostly attributed their child's problems to learning difficulties and tends to reject the biomedical explanation for ADHD. Thus, in Indian culture solely a psychiatric label may be inadequate for ADHD intervention strategy. (Patel and Prince, 2001; Rodrigues et al. 2003).

ADHD is a "serious public health problem" (Frances E. Kuo &Andrea Faber Taylor, 2004). The impact of this disorder is pervasive. Children having ADHD could have poorer parent-child-sibling relationship, interpersonal attachment, and academic underachievement in comparison to non-ADHD children, which can result in low self-esteem and self-evaluation (Lecendreux, Konofal and Faraone, 2011). Since ADHD is a lifelong condition, persistence of ADHD in adolescence and adulthood contribute to academic underperformance, adjustment problems, antisocial behaviour, road traffic accidents, sexual problems, and crimes. These things can create a negative impact on the society and family and thus becomes a major public health worry (Flory et al., 2006).

Keeping in mind poor long-term outcomes of ADHD, a holistic treatment combining pharmacology, psychosocial and educational interventions are required to cope up with the present under-resourced infrastructure. The present article tried to tailor a behavioural and multimodal interventions for children with ADHD and to find the efficacy of the two treatment modules. Behavioural interventions focused on to manipulate environmental antecedents and consequences; allowed individualized targeting of behavioural deficits and excesses (Frazier and Merrell, 1997). Whereas Multimodal or

'Macro-paradigm' model of ADHD integrates neurobiological, cognitive, affective, behavioural, and social-familial paradigms to increase treatment efficacy (Teeter and Clikeman, 1995).

Method

A cross-sectional study conducted at Kolkata urban district. 20 ADHD families were chosen through purposive sampling, consisted of biological parents and children meeting DSM-5 ADHD Combined Type criteria (APA, 2013). Age of the children ranged between 6 and 10 years. Minimum educational level selected for the parents to participate in the research was 12th standard. The Bio Ethics Committee for Human and Animal Research Studies, University of Calcutta approved the study.

Sample Characteristics

The sample comprised of 20 children diagnosed with ADHD Combined type. The 20 participating families were randomly divided into two groups. 90% of the participants were boys. Most parents (13 out of 20; 65%) had only one child and their mothers were home makers. All children were on medication at the time of participation. None of them received psychological intervention prior to this study. Children with ADHD of the two groups did not differ significantly in age, gender, and medication duration (Mann-Whitney U test was performed; alpha level was set at 0.05).

Procedure

Two groups were formed each consisted of 10 ADHD children and their parents. To be eligible, all children were required to have an IQ of 80 and above. All the children were scheduled for their initial diagnostic interview and an IQ screening test. Group A received Behavioural intervention and Group B received Multimodal intervention. Baseline assessment followed by psychological intervention, provided on an individual-family basis. Altogether 10 psychotherapeutic sessions were conducted and after the end of each session, both the groups were provided with homework assignments, behaviour diary, attention-enhancing games booklet and written handout summarizing the main points discussed in the session. On completion of the 10th session, post-intervention assessments were conducted. Pre and post treatment change was statistically analysed.

Brief overview of the Intervention process conducted:

Group A	Group B
Therapy Conducted: Behaviour Therapy	*Therapy Conducted:* Multimodal Therapy
Spacing: Once a week	*Spacing:* Once a week
*Number of Sessions:*10	*Number of Sessions:* 10
Duration of each session: 60 mins (approx..)	*Duration of each session:* 60 mins (approx..)

Brief overview of Session-wise Intervention process followed:

Group A	Group B
Session 1: (Conducted with both Child & Parents) Baseline assessment; Psychoeducation; Behavioural case formulation.	*Session 1:* (Conducted with both Child & Parents) Baseline assessment; Psychoeducation; Emotion focused behavioural case formulation.
Session 2: (Conducted with only parents) Focused on parenting; use of positive reinforcement	*Session 2:* (Conducted with only parents) Focused on boundaries of subsystems; functional/ dysfunctional transactional patterns.
Session 3: (Conducted with only parents) Discussed on 'Parenting Similarity;' behavioural strategies to improve listening skills.	*Session 3:* (Conducted with only parents) 'Parenting similarity;' use of positive affective words in communication; understanding child's interpersonal world and attachment style.
Session 4: (Conducted with both Child & Parents) Reflections on previous week; make sure parents were working together; focused on play.	*Session 4:* (Conducted with Child & Parents) Value of joint play emphasized; need to develop feeling of being understood and appreciated.

Session 5: (Conducted with only Parents) Recap on progress and difficulties. Introduction of punishment techniques.	*Session 5:* (Conducted with Child & Parents) Recap on progress and difficulties; introduction of punishment techniques; focused on peer and family; how to develop new relationships 'play date.'
Session 6: (Conducted with only Parents) Emphasized on routines and structure; joint play; breaking of complex task into smaller pieces; strategies to reduce distractions.	*Session 6:* (Conducted with both Child & Parents) Emphasized on routines and structure; joint play; breaking of complex task into smaller pieces; strategies to reduce distractions.
Session 7: (Conducted with both Child & Parents) Introduction to Token Economy.	*Session 7:* (Conducted with Child & Parents) Introduction to Token Economy.
Session 8: (Conducted with only Parents) Recap on progress and difficulties; encourage parents to find their own solutions to difficult behaviour.	*Session 8:* (Conducted with Child & Parents) Recap on progress and difficulties; educated on the need for continuing the skills learned to relieve the acute distress and thereby not 'exact cure.'
Session 9: (Conducted with both Child & Parents) Review the handouts provided after each session; encourage parents to try out strategies outside home; remind parents that next week is last session, encourage to make a list of issues to discuss.	*Session 9:* (Conducted with Child & Parents) Focused on future aspirations and how the child will reach the desire targets? Which corners of the family are enjoyable now and which are yet to recover? Discussed on how each member contributes to relationship functioning.
Session 10: (Conducted with both Child & Parents) Review the programme progress; discuss what the mother understands about the strategies; what changes has she made already and what she thinks need to change further; what changes she finds in her child; need to remind changes do not occur overnight; need to be consistent and persistent; work together; anticipate difficult times in the future; read the handouts.	*Session 10:* (Conducted with Child & Parents) Review the programme progress; recap using the diaries; encourage the child to recognize his or her personal assets and the interpersonal support that may be available to him or her; emphasis on self-control, increased self-abilities, enjoying relationships; need to remind changes do not occur overnight; need to be consistent and persistent; work together; anticipate difficult times in the future; read the handouts.

Attention Games

After each session, the therapist provided attention games booklets consisted of colourful, simple, and short 'attention skills' activities to the parents of both the groups as between-session homework assignments. The purpose of its inclusion in the present research was not to cognitively retrain the child but to increase structured positive engagement of the child with his parents.

Tools Used

Information Blank: A socio-demographic data sheet was prepared that includes both parents and child-related items such as age, gender, education, treatment duration, nature of treatment received. Information on physical and mental illness and the like.

ADHD Symptom Checklist – 4 (ADHD – SC4) (Parent version): A screening instrument developed by Gadow and Sprafkin (1997) for the behavioural symptoms of ADHD. The test-retest reliability ranged from r=0.64 to r=0.72.

Ravens Coloured Progressive Matrices (RCPM): Developed by Raven et al., (1986). It is a widely used nonverbal intelligence test for younger children. A split-half reliability estimates of 0.90 was reported (Jensen, 1974); validity ranged between 0.60 and 0.70 (Ghuman, 1978).

Statistical Analyses

Statistical Package for Social Sciences (SPSS) version 16.0 was used for data analyses. Descriptive statistics (Mean±, SD, frequencies) were used for studying the sample characteristics. To assess the pre-and post-treatment change, within-group repeated measure analyses

(Wilcoxon-Signed Rank Test) and Mann-Whitney U-Test between the groups was conducted. Ipsative scores were computed by subtracting the post-intervention scores from the pre-intervention scores. Ipsative scores represent pre-to-post treatment change. To measure the efficacy of the two interventions, ipsative scores of the two groups were statistically compared using Mann-Whitney U Tests. All statistical tests were two-tailed and alpha level was set at 0.05.

Results

Table 1. Mother reported pre-to-post intervention changes within the two groups.

Outcome Measures (Symptom Severity)	Groups	Mother-reported changes		Z Score	p
		Pre-intervention assessment	Post-intervention assessment		
		Mean ± SD	Mean ± SD		
ADHD (Inattentive Type)	Group A	18.1 ± 5.63	14.8 ± 4.89	2.572	.010*
	Group B	19.7 ± 4.74	13.3 ± 7.54	2.603	.009*
ADHD (Hyperactive/ Impulsive Type)	Group A	11.1 ± 4.30	8.80 ± 3.05	2.508	.012*
	Group B	17.7 ± 6.45	12.0 ± 6.48	2.502	.010*
ADHD (Combined Type)	Group A	29.0 ± 7.64	23.5 ± 5.84	2.721	.007*
	Group B	37.4 ± 10.46	25.3 ± 13.33	2.654	.008*

(Group A received Behavioural Intervention; Group B received Multimodal Intervention)

Table 2. Father reported pre-to-post intervention changes within the two groups.

Outcome Measures (Symptom Severity)	Groups	Father-reported changes		Z Score	p
		Pre-intervention assessment	Post-intervention assessment		
		Mean ± SD	Mean ± SD		
ADHD (Inattentive Type)	Group A	18.1 ± 4.12	15.0 ± 4.71	2.298	.022*
	Group B	15.9 ± 5.07	11.6 ± 3.72	2.712	.007*
ADHD (Hyperactive/ Impulsive Type)	Group A	11.4 ± 4.30	8.50 ± 4.22	2.675	.007*
	Group B	15.5 ± 6.72	9.9 ± 3.84	2.673	.008*
ADHD (Combined Type)	Group A	29.3 ± 6.50	23.4 ± 8.10	2.807	.005*
	Group B	31.5 ± 9.92	21.5 ± 7.28	2.812	.005*

Table 3. Ipsative scores (Mean± SEM) as measures of efficacy of the two interventions.

	Ipsative Scores		U	p	Ipsative Scores		U	p
	GROUP A Mother	GROUP B Mother			GROUP A Father	GROUP B Father		
ADHD (Inattentive Type)	+3.3 ± 2.54	+6.4 ± 1.53	26.0	.068	+6.4 ± 1.07	+4.3 ± 0.82	37.0	.321
ADHD (Hyperactive / Impulsive Type)	+2.3 ± .56	+5.7 ± 1.96	24.5	.050*	+2.9 ± 0.53	+5.6 ± 1.77	26.0	.068
ADHD (Combined Type)	+5.5 ± 0.95	+12.1 ± 3.19	25.5	.061	+5.9 ± 1.61	+10 ± 1.38	23.5	.044*

Discussion

Table 1 and 2 shows the parents reporting ADHD symptom severity score at baseline. The statistical analyses using Wilcoxon tests revealed parents of both the groups reported significant reductions in the ADHD symptoms severity status of their child following both the interventions. Thus, both behavioural and multimodal treatment paradigm found to be an effective management for ADHD. In Table 3, pre-post assessment score differences (ipsative scores) were considered for each participant to analyse the efficacy of the two interventions. The study reflected that both behavioural and multimodal therapeutic approaches were found to be effective in reducing the severity of the ADHD core symptoms. Behavioural interventions help parents stop ineffective communication patterns with their child by reinforcing child's prosocial behaviour and to extinguish unwanted behaviours (Lee et al. 2012). Multimodal interventions consider both the intensity of the symptoms and its pervasiveness.

Beyond symptom reduction, comparing the treatment effectiveness (Table 3), based on the reports of fathers of children with ADHD, multimodal approach was found to have a significant pre-to-post treatment change with respect to ADHD core symptoms severity (U=23.5; p=.04). Mothers of children with ADHD reported more improvement with respect to hyperactivity/impulsivity symptoms of their children following multimodal intervention. Since different psychotherapeutic concepts have been integrated in the multimodal therapy, it is difficult to pin-point which treatment component yielded more improvement. However, ADHD is a lifelong condition, it is fundamental to understand the long-term outcomes of the different treatment modalities (Costa Dias et al. 2013).

This study dealt with the ADHD heterogeneity. All the children were on stimulant medication throughout the intervention process. Stimulant medication therapy addresses the deficits experienced by the child through manipulation of the neurological substrates. Whereas psychosocial interventions helped in restructuring the types of demands made on the child and through rearranging environmental contingencies to increase work performance, rule-governed behaviour, compliance, and positive family ambience. The disorder is still poorly recognized and lack public policies to address the condition; intervention-based research is needed to treatment access.

Moreover, the study included session-wise clear guidelines for the management of ADHD. Between-session assignments helped to increase parental skill and use of attention enhancing games booklet has an impact on parent-child positive engagement. Providing written handouts at the end of each session served as a reminder of the steps involved in conducting a particular between-session assignment that helped parents for the genuine understanding about the disorder. Combining both treatments provide a powerful tool for managing the behavioural deficiencies of children with ADHD.

In near future, long-term follow-up studies of psychosocial interventions will be helpful to further advance the concepts and knowledge on ADHD.

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