The Utilization of d-CPT Test in Differentiation of Attention Deficit Hyperactivity Disorder and Anxiety Disorders in Children

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INTRODUCTION

There is a growing body of research on utilization of computerized continuous performance tests (CPTs) for differential diagnosis and response to medication in the follow-up of the patients[1]. MOXO test, which is a recently developed CPT test that incorporates distractors during continous performance is shown to be more specific in detecting domains that are affected in ADHD[2]. Anxiety disorders may mimic symptoms of ADHD; repetetive intrusive anxious ruminations may present as inattention and fidgeting and restlessness can be caused by autonomic hyperarousal. We aim to assess the role of d-CPT distractor incorporated CPT). MOXO test as a tool to aid in differential diagnosis of anxiety disorders and ADHD.

MATERIALS AND METHODS

A total of 50 patients, with an age range of 6-14, from two child psychiatry clinics were selected (Table 1). All patients received a thorough diagnostic evaluation by a specialized child and adolescent psychiatrist and diagnoses were established based on clinical evaluation and clinical rating scales. 32 patients with a diagnosis of ADHD and 18 patients with diagnoses of Anxiety Disorders according to DSM 5 [3] criteria were asked to perform MOXO d-CPT (Figure 1), and the results in different domains (attention, hyperactivity, impulsivity and timing) were compared. The data was analyzed for both groups for each domain with 4 different conditions (without distractor, with auditory distractor, with visual distractor and with combined distractor effects).

Table 1 Characteristics of the Patient Population

	ADHD	Anxiety Disorders	Total
Male	29	11	40
Female	3	7	10
Comorbidity	11	9	20
Medication Use	17	9	26

RESULTS

The results of d-CPT test revealed significant differences in areas between subjects with ADHD and Anxiety Disorders in omission errors, timing and hyperactivity indices but not for impulsivity indices (Table 2).

When results from omission and commission ratings (Attention and Impulsivity indices) were combined, differences among ADHD and Anxiety groups were statistically significant for no distractor, visual and combined distractor conditions (p=0.011, p=0.023, p=0.041 respectively), but not for auditory distractor condition (p=0.088).

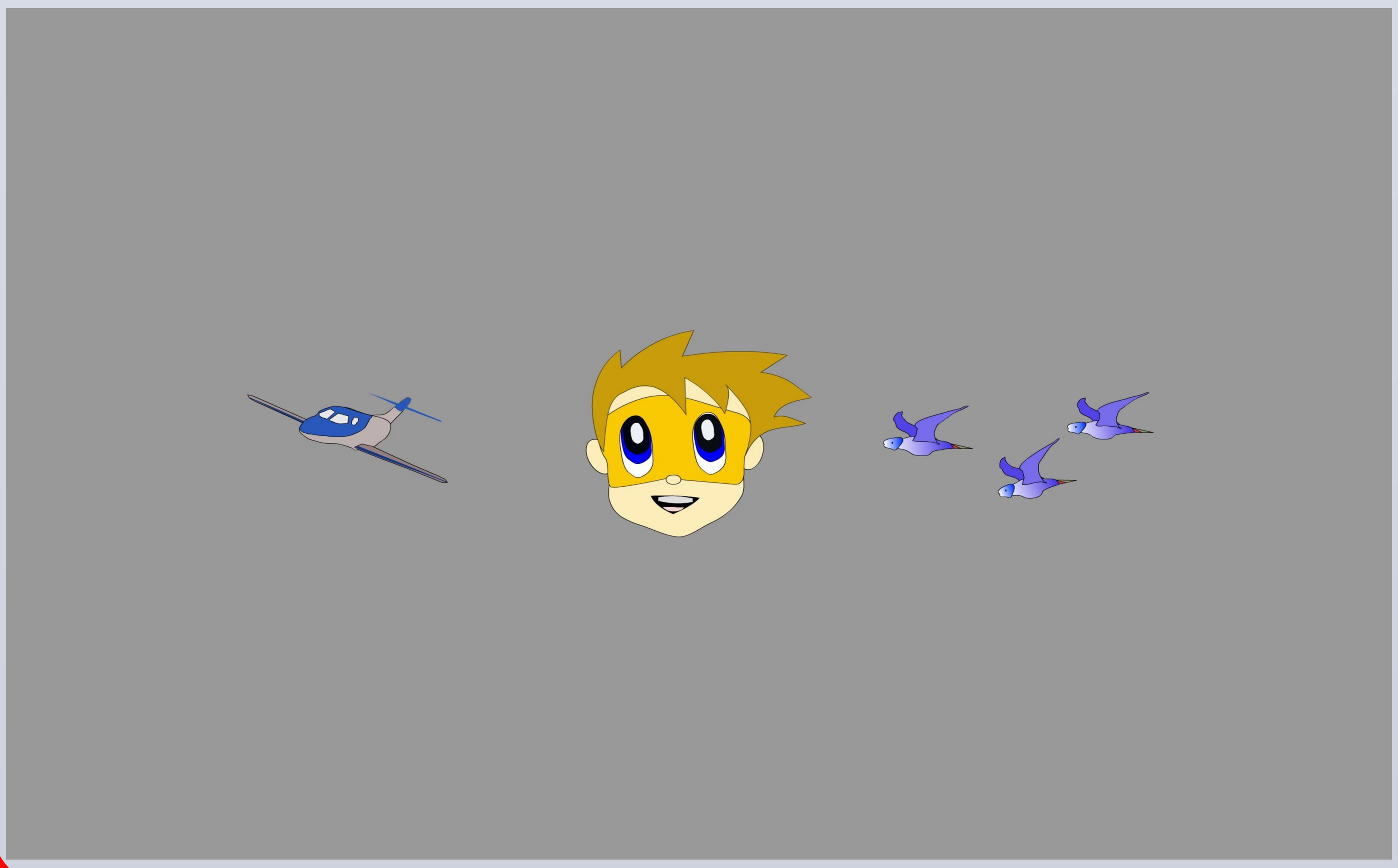
When results of conditions were combined within a given index, the results of Attention, Timing, Impulsivity and Hyperactivity differed significantly. (Mann-Whitney U Test; p=0.024, p=0.039, p=0.035, p=0.002 respectively).

Different distractor conditions were also analyzed individually. When we added all the domains together for each condition (meaning results of all indices for no distractor, visual distractor, auditory distractor and combined distractor) the results differed significantly between patients with ADHD and anxiety disorders. (Independent Samples Mann- Whitney U Test; p=0.002, p=0.06, p=0.010, p=0.009 respectively).

The distribution of data did not differ significantly accross gender.

When subjects with ADHD were compared among each other according to medication use, comparison revealed significant differences in domains of attention indices except for combined stimuli condition (p=0.037,0.002,0.020 and 0.089 respectively) . The rate of commission errors (impulsivity index) was not significantly different among groups.

Figure 1: Moxo d-CPT Test Screenshot (Target and Visual Distractor)



RESULTS (continued)

Comparison of subjects who are not on medication for ADHD and subjects with anxiety disorders yielded powerfully significant results for attention, timing, impulsivity and hyperactivity indices (p=0.01, p=0.04, p=0.05, p=0.01). When results were compared across distractor conditions, groups also differed significantly (no distractor; p=0.00, visual distractor; p=0.00, Auditory distractor; p=0.01, combined distractor p=0.01).

The differences between reaction times in the beginning and the end of the study was also statistically significant between medicated and nonmedicated ADHD subjects. (p=0.048)

Interestingly, when subjects who are on medication for ADHD and subjects with anxiety disorders were compared, the results did not differ significantly except for the hyperactivity index total score (p=0.035).

Number of fluctiations were compared across groups and no statistical difference were found.

Table 2: Between-Group Differences According to Indices and Conditions

Index	Condition	P value
Attention	no distractor	.026*
Attention	visual distractor	.005*
Attention	auditory distractor	.281
Attention	combined distractors	.028*
Timing	no distractor	.017*
Timing	visual distractor	.023*
Timing	auditory distractor	.063
Timing	combined distractors	.018*
Impulsivity	no distractor	.036*
Impulsivity	visual distractor	.064
Impulsivity	auditory distractor	.042*
Impulsivity	combined distractors	.262
Hyperactivity	no distractor	.002*
Hyperactivity	visual distractor	.004*
Hyperactivity	auditory distractor	.001*
Hyperactivity	combined distractors	.004*

*: statistically significant; independent samples, Mann-Whitney U test ($p<0.05$)

DISCUSSION

Our results show children with ADHD conduct more omission errors than anxious counterparts when presented with no distracors, visual distractors and visual and auditory combined distractors. There were no statistical differences between groups when presented with auditory stimulus. Our results are in line with previous research which showed that visual distractors are better than auditory ones [4].

ADHD subjects engaged in more commission errors than their peers with anxiety disorders; however, this difference was not evident when presented with distracting stimuli. We suggest that presentation of visual and auditory stimuli may further trigger anxiety symptoms (especially self doubt, perfectionistic views, hypervigilance) and may lead to more commission errors in subjects with Anxiety Disorders, thus closing the gap between ADHD and anxiety-disordered children.

Hyperactivity index, by showing execution of hitting an alternative key on keyboard, or hitting the desired key multiple times may be seen as a measure of engaging in unwanted behavior. This is in line with our clinical observation that ADHD subjects were getting easily bored and did engage in behaviors to mock the test and the clinician. This index may be seen as an index of similar behavior in the classroom and home; engaging in seemingly unrelated and unsolicited behavior; such as limit-testing, although not universally disruptive.

Our results suggest that ADHD medications are helpful with attention (including reaction time) and impulsivity symptoms, but not with hyperactivity index. It can be argued that hyperactivity index of this test may be measuring these “limit-testing” behavior rather than true hyperactivity, which has strong clinical response to ADHD treatment.

In summary, children with ADHD and Anxiety Disorders had significant differences on d-CPT test, especially when presented with concurrent visual distractor stimuli. ADHD medications have clear effect in correcting these differences. Errors of omission are more closely linked to “pure ADHD” symptoms than commission errors, which may tap into symptoms that may also be present in Anxiety Disorders. Hyperactivity index of d-CPT may be measuring a tendancy to go against the norm, or limit testing behavior instead of true hyperactivity.

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