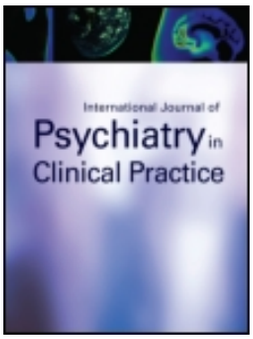

International Journal of Psychiatry in Clinical Practice

ISSN: 1365-1501 (Print) 1471-1788 (Online) Journal homepage: www.tandfonline.com/journals/ijpc20

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Niels Peter Nielsen & Elisabeth Hemmersam Wiig

To cite this article: Niels Peter Nielsen & Elisabeth Hemmersam Wiig (2011) AQT cognitive speed and processing efficiency differentiate adults with and without ADHD: A preliminary study, International Journal of Psychiatry in Clinical Practice, 15:3, 219-227, DOI: 10.3109/13651501.2011.582538

To link to this article: https://doi.org/10.3109/13651501.2011.582538

International Journal of Psychiatry in Clinical Practice, 2011; 15: 219–227

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ORIGINAL ARTICLE

AQT cognitive speed and processing efficiency differentiate adults with and without ADHD: A preliminary study

NIELS PETER NIELSEN[1] & ELISABETH HEMMERSAM WIIG[2]

[1]*Vesterbro-Enghave Psykiatrisk Center, Hvidovre Hospital Department of Psychiatry, Copenhagen, Denmark and*
[2]*Communication Disorders, Boston University, Boston, MA*

Abstract
Objective. We evaluated the hypotheses that A Quick Test of Cognitive Speed (AQT) single- and dual-dimension naming speed measures would differentiate normal adults and adults with ADHD before medication and that there would be no differences between groups after stabilization with medication. *Methods.* Thirty adults with ADHD, aged 18–43, were evaluated with the AQT color (C), form (F) and color–form combination (CF) naming tests before and after medication with methylphenidate. Thirty age- and sex-matched normal adults served as controls. *Results.* Among adults with ADHD, pre-medication naming times (s) for C, F, and CF were significantly longer and overhead [CF – (C + F)] significantly larger than post-medication. Before medication, C, F and CF naming and processing efficiency (overhead) (s) differed significantly between ADHD adults and controls. After medication, there were no significant differences between groups. When we used fail criteria for dual-dimension naming (>60 s) and overhead (processing efficiency) (>+6 s) together the sensitivity was 93% and specificity 100%. *Conclusions.* Within the study limitations, findings suggest that the processing-speed and efficiency measures in AQT may be used to screen adults for executive dysfunction and reduced cognitive control associated with ADHD.

Key Words: *Adults, attention deficit/hyperactivity disorders, AQT, processing speed, cognitive control, methylphenidate*

Introduction

Attention deficits and executive function disorders are hallmarks of attention deficit hyperactivity disorders (ADHD) and persist from childhood to adulthood [1–3]. In psychiatric practice, the impact of ADHD on functional abilities is generally established qualitatively by using behavioral rating scales [4]. The impact of ADHD on attention and executive functions can be established quantitatively with broad-based or specific neuropsychological tests [5–11]. Processing-speed tests are commonly used to assess specific executive functions in ADHD. Of these, the Stroop Color–Word Test [6] evaluates inhibition, Conner's Continuous Performance Test II [7,8] and the Integrated Visual and Auditory Continuous Performance Test [9,10] evaluate inhibition and sustained attention. The Trail Making Test [11] evaluates attentional abilities, including executive control and cognitive set shifting. However, most standardized processing speed tests do not allow for test–retest within short time intervals and some require advanced technological support and interpretation is relatively complex [7–10].

A Quick Test of Cognitive Speed (AQT) [12,13] is a screening test, designed to assess single- and dual-dimension processing speed by using rapid, continuous, automatic naming tasks. Color–Form Naming features two single-dimension tests (color and form naming) and one dual-dimension test (color–form combination naming). Each test uses 40 visual stimuli and the results are reflected by timed naming speed in seconds. The single-dimension tests measure reaction + retrieval + response time. The dual-dimension test measures processing speed and overhead from increased demands on attention, working memory, and set shifting (switch cost). AQT Color–Form Naming has proven useful in assessing changes in cognitive function secondary to neurological and neuropsychiatric disorders [14–16]. Administration and scoring are quick and easy,

Correspondence: Professor Elisabeth Hemmersam Wiig, PhD, Communication Disorders, Boston University, 2131 Reflection Bay Drive, Arlington, TX 76013, USA. E-mail: ehwiig@krii.com

(Received 17 November 2010; accepted 14 April 2011)

ISSN 1365-1501 print/ISSN 1471-1788 online
DOI: 10.3109/13651501.2011.582538

requiring from 3 to 5 min for normal adults, making it a suitable candidate for screening for a variety of types of cognitive impairment. The purpose of this study was to evaluate the clinical utility of AQT in psychiatric practice with ADHD adults by obtaining quantitative measures of attention, working memory and set shifting, executive functions validated to be impaired in ADHD [17–19].

In normally developing adolescents and adults, naming the visual stimuli in AQT is highly automatic and there is no evidence of learning or habituation during repeated (10-min) naming of color–form combinations [12]. Maximum levels of processing speed are reached at age 15 and show minimal change with advancing age [20,21]. AQT color–form combination naming activates cortical regions that are implicated in executive attention, visual working memory and set shifting. Thus, functional neuroimaging (rCBF and fMRI) of normal adults during AQT color–form naming shows activation of bilateral occipital-temporal-parietal and sub-cortical brain regions, including the hippocampus [12,13,22].

Our objectives were clinical and sought to evaluate the use of the AQT processing speed measures before and after treatment of adults with ADHD with methylphenidate and compare these to performances by normal controls. We hypothesized that (a) processing speed, as measured by AQT color, form and color–form combination naming and overhead (s), would differ significantly in ADHD adults pre- and post-medication with methylphenidate, (b) dual-dimension naming speed and processing efficiency, as measured by the overhead, would be significantly reduced in ADHD adults pre-medication as compared to normal controls, and (c) there would be no significant differences between ADHD adults post-medication and normal controls.

Methods

Subjects

Thirty adults, 14 males and 16 females, participated after referral to a regional, outpatient psychiatric center for evaluation of ADHD symptomatology and possible treatment with methylphenidate. They ranged in age from 18 to 43 years (M = 28.3, SD = 6.6 years) and had completed grade 10 and vocational or professional training. ADHD diagnoses were established according to DSM-IV-TR (314.01) and ICD-10 criteria (F90.0; F90.9) [23,24]. Twenty-one patients met ICD-10 F90.0 (hyperkinetic disturbances) and nine met F90.9 (hyperkinetic disturbances, unspecified) criteria. No additional subtypes were identified. Several participants exhibited impaired academic achievement, difficulties with employment, and co-morbidities, which appear common among adults with ADHD [25–27]. Nine patients met ICD-10 criteria for substance abuse/addiction (F10, F12, F19, F63.0), three met criteria for disturbed personality structure (F60.0, F60.1, F60.9), three for affective disorders (F23.1, 31.8, 33.1), and two met criteria for OCD (F42.2). None received prescription medication for ADHD at intake. Subsequently, they were treated with methylphenidate (Ritalin, Ritalin-SR, Motiron or Concerta) and continued with medications appropriate for treating existing co-morbidities.

The treatment protocols concurred with prevailing Danish psychiatric practice and started with a referral for a diagnostic evaluation of possible ADHD symptomatology, based on a psychiatric interview and administration of ASRS-V1.1. After initial indications of responsiveness to methylphenidate, dosage was increased only with each patient's acceptance after shared evaluation and discussion by the patient and the psychiatrist and concurrent monitoring with AQT. Stabilization of ADHD symptoms with methylphenidate was determined in collaboration between patient and psychiatrist based on positive evidence of reduced ADHD symptomatology. All patients completed treatment till stabilization of ADHD symptoms, as indicated by psychiatric interviews. Treatment lasted on average 6 weeks with a range from 4 to 11 weeks. Patients received a stable dose of methylphenidate for 2 weeks before post-medication evaluation with AQT.

Thirty age-and sex-matched normal adults, without ADHD symptomatology or other neuro-psychiatric disorders, served as controls. The controls were recruited from the urban community in response to announcements to personal contacts. They were informed that a short questionnaire of well being and medical background would be administered. The purpose was to exclude adults with recent changes in daily habits or with histories of neuro-psychiatric disorders. All participants signed informed consent forms in accordance with the Declaration of Helsinki.

Materials and administration

Patients completed the Adult Self-Report Scale (ASRS-V1.1) [4] before medication and ratings ranged from 22 to 70 points (M = 47.4; SD = 13.3), indicating likely ADHD (i.e. >20 points). AQT color (C), form (F) and color–form combination (CF) naming were administered to patients (a) before medication with methylphenidate to establish a baseline, (b) during office visits for monitoring and adjusting methylphenidate dosages, and (c) after stabilization of ADHD symptoms with methylphenidate. AQT was administered once to the control group.

AQT color naming (C) requires rapid naming of 40 randomly sequenced squares rendered in black, blue, red or yellow. Form naming (F) requires rapid naming of 40 randomly sequenced, geometric shapes (circle, line, square or triangle) rendered in black. Color–form naming (CF) requires rapid naming of combinations of the colors and shapes (e.g., red circle). AQT color, form and color–form naming are highly reliable ($r = 0.90$ to 0.95) [12,13]. Normative naming times (s) are not affected by sex or education after attainment of literacy (Grade 8) and minimally affected by age with a slowing of about 1 s per decade between ages 15 and 60 years [20,21]. In normal adults, AQT single-dimension naming (color, form) measures automatized naming of highly familiar visual stimuli. Dual-dimension CF naming measures switch cost and the extra time required for saying two words in sequence (articulation time).

We calculated a measure of processing efficiency (overhead), which reflects the difference between the sum of the C and F naming times, subtracted from the CF naming time [CF – (C + F)]. The overhead measure (s) was norm-referenced in a study with 270 normal adults (ages 18–70 years) [28]. Results were analyzed for the total group and for three age-level cohorts (ages 18–34, 35–54 and 55–70), each with 90 adults. ANOVA indicated significant mean differences between the processing-speed measures (sec.) for the total group and the 18–34 and 35–54 year age-level cohorts. The average normal overhead was 4.62 s (SD = 5.55) for 18–34-year-olds, 2.40 s (SD = 5.59) for 35–54-year-olds, and 1.53 s (SD = 4.99) for 55–70-year-olds. In clinical practice, an overhead larger than + 1SD of these means would suggest executive dysfunction related to processing efficiency and cognitive control. Because the standard deviations for the 18–34-year- and 35–54-year-olds (5.55 and 5.59 s, respectively) were similar, we used an overhead larger than +6 s as the fail criterion for normality.

A psychiatrist administered AQT, a psychiatric interview, and a behavioral rating scale (ASRS-V1.1) during a standard medical work-up for intake. The same psychiatrist administered a psychiatric interview and AQT concurrently during weekly or bi-weekly office visits during treatment with methylphenidate until stabilization of ADHD symptoms. The AQT tests were administered in the standard order, but color naming was administered again after the completion of C, F and CF naming to probe for consistency.

Statistical analysis

One-way ANOVA with post hoc analyses evaluated the significance of mean C, F, and CF naming-time differences between: (a) the ADHD pre- and post-medication processing-speed measures, (b) the ADHD pre-medication and control measures, (c) the ADHD post-medication and control measures. The significance of mean differences in overhead (s) was evaluated with *t*-tests. These statistical analyses were performed on lognormal (ln) transformations of time scores. Associations between AQT processing-speed measures were evaluated with Pearson correlations (*r*). Sensitivity and specificity were determined by comparing individual naming time measures to criterion-referenced cut-off times (s), set at + 1 SD of the mean (a) for the upper limits of normal performance for CF and (b) for the previously established normal size of the overhead for 18–60-year-old age cohorts [13,28]. Null hypotheses were rejected at $P < 0.01$.

Results

Means and standard deviations for the AQT naming times (s) for the ADHD group pre- and post-medication and for the control group are shown in Table I. The last column indicates the amount of overhead [CF – (C + F)] (s). No outliers were removed from the data set. Pre-medication, the means for the ADHD group for F and CF naming were in the slower-than-typical range and the overhead was in the larger-than-normal range (i.e. between +1 and +2 SD). Post-medication, the ADHD group means for C, F, and CF naming and overhead were in the typical/normal range (i.e. <+1 SD of the mean). The control group means for all measures were in the typical/normal range (i.e. <+1 SD of the mean). Figure 1 illustrates the individual changes in CF naming times (i.e. dual-dimension naming) for each of the adults with ADHD, pre- and post-medication with methylphenidate.

Tests for normality of the sampling distributions for each variable accepted the normality assumption for all AQT processing-speed measures. However, assumptions for homogeneity of variance were rejected. Accordingly, we applied lognormal (ln) transformations to the C, F and CF time scores (s). One-way ANOVA with post hoc analyses (Tukey HSD) with lognormal (ln) transformed values tested the significance of mean differences between ADHD pre- and post-medication and control group means. The results of ANOVA with post-hoc analyses are shown in Table II. The main effect proved significant for C ($F = 13.77$; $P = 0.0075$; $\eta^2 = 0.240$), F ($F = 21.21$; $P = 0.0028$; $\eta^2 = 0.328$) and CF ($F = 62.42$; $P = 0.0002$; $\eta^2 = 0.589$). Post-hoc analyses statistics (Tukey HSD) indicated that the differences between the ADHD ln means pre- and post medication and between the ADHD pre-medication

Table I. Means and standard deviations for AQT color, form, color–form naming and overhead (s) for 30 adults with ADHD and 30 age- and sex-matched controls.

AQT	Color M (SD)	Form M (SD)	Color–Form M (SD)	Overhead M (SD)
ADHD				
Pre-medication	24.60 (3.98)	30.13 (6.26)	67.93 (10.66)	13.07 (6.92)
Post-medication	20.23 (3.14)	22.63 (4.23)	46.07 (7.17)	3.20 (3.92)
Non-ADHD				
Controls	20.73 (2.94)	23.53 (3.50)	47.53 (5.82)	3.27 (3.29)

and control group means were significant (accepted). This supported the hypothesis that AQT processing speed would be significantly slower, with longer time measures, for adults with ADHD at intake before medication with methylphenidate than for controls.

Post-hoc analysis indicated that the difference between the ADHD post-medication and control group lognormal (ln) transformed means were non-significant (i.e. rejected). The overhead times (s) were not lognormal transformed, because they could have either positive or negative values. A two-tailed *t*-test, assuming unequal variance, evaluated the significance of a mean difference between the ADHD overhead pre- and post-medication and the difference proved significant ($t = 6.80$; $P < 0.0000$; $\eta^2 = 0.44$). A two-tailed *t*-test, assuming unequal variance, evaluated the significance of the difference between the ADHD post-medication and control overhead means and the difference proved non-significant ($t = -0.07$; $P = 0.94$; $\eta^2 = 0.00$). This supported the hypothesis that there would be no significant differences in the single- (C, F) and dual-dimension naming speed measures (CF) or overhead (processing efficiency) between the ADHD group after medication and the control group.

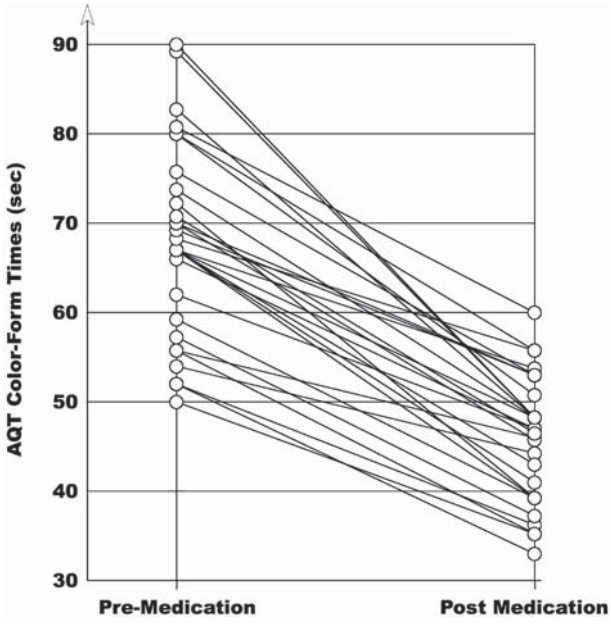

Figure 1. AQT color-form combination naming times (s) for each of 30 adults with ADHD without medication (left) and after stabilization of ADHD symptoms with methylphenidate (right).

Figure 2 shows a graph of CF naming times (s) for each ADHD adult pre- and post-medication, compared to naming times for the controls. Figure 3 shows a graph of the overhead (s) for each adult with ADHD pre- and post-medication, compared to that for the controls. In both figures, the CF naming-time and overhead measures (s) were ranked in the ADHD group post-medication.

Correlations (Pearson *r*) were calculated to explain the degree of association between the AQT processing-speed measures. In the ADHD group, correlations between C, F and CF naming times pre- and post-medication ($r = 0.67$–0.83; $P < 0.0001$) were significant, effect sizes large, and power values were between 0.91 and 0.99. In the ADHD group pre-medication, the correlation between the CF naming and overhead times ($r = 0.35$; $P = 0.06$) was non-significant and the effect size small. Post-medication, the correlation between the CF naming and overhead times ($r = 0.37$; $P = 0.04$) was significant, the effect size small, and the power value 0.24. In the control group, the correlation between the CF naming and overhead times ($r = 0.46$; $P = 0.011$) was significant, the effect size medium, and the power value 0.46. The small-to-medium effect sizes for the associations between dual-dimension naming speed (CF) and overhead suggest that the overhead measures separate aspects of executive dysfunction.

Before medication individual C naming times by the ADHD adults often varied between the first (C1) and second administration (C2). One-way ANOVA comparison of C naming means for the first (M = 24.60 s; SD 3.98) and second administration (M = 27.73 s; SD 1.20) before medication proved non-significant ($F_{1,\ 58} = 5.02$; $P = 0.0289$). Mean differences in C naming for the first and second administration after stabilization (M = 20.23 s; SD 3.14 and M = 21.47 s; SD 0.56) ($F_{1,\ 58} = 2.35$; $P = 0.1307$) also proved non-significant. Correlations (*r*) between ADHD C naming means pre- ($r = 0.85$; $P < 0.0001$) and post-medication ($r = 0.86$;

Table II. Significance of mean differences (s) between 30 adults with ADHD pre- and post- medication and 30 controls based on one-way ANOVA with post hoc analyses of ln values for AQT color (C), form (F) and color–form (CF) combination naming.

	df	SS	MS	*F*	*P*	Tukey HSD
C	2	0.6648	0.3324	13.77	0.0075	ADHD pre vs post: 4.84*
	87	2.1005	0.0241			ADHD pre vs controls: 4.18*
						ADHD post vs controls: 0.67
F	2	1.3749	0.6875	21.21	0.0028	ADHD pre vs post: 8.57*
	87	2.8204	0.0324			ADHD pre vs controls: 7.22*
						ADHD post vs controls: 1.35
CF	2	2.7668	1.3834	62.42	0.002	ADHD pre vs post: 14.30*
	87	1.928	0.0222			ADHD pre vs controls: 12.97*
						ADHD post vs controls: 1.32

Tukey HSD accepted. Pre, pre-medication; Post, post-medication.

$P < 0.0001$) were significant, effect sizes large, and power values 0.99. Accordingly, these single-dimension naming times were consistent both at intake and after treatment with methylphenidate.

Sensitivity and specificity were calculated to evaluate the clinical utility of the AQT tests in differentiating patients with ADHD pre-medication from normal controls (Table III). Pass/fail decisions were based on normative naming-time criteria (s) for the upper limits of the normal range of naming times (i.e. at +1 SD of the mean) [12,13]. The pass criteria for normal performance were: (a) 25 s or less for C, (b) 30 s or less for F, (c) and 60 s or less for CF naming. Normative criteria for the expected amount of overhead [CF – (C + F)] for normal 15–54-year-olds determined pass/fail performance [28]. The pass criterion for normal overhead was + 6 s or smaller. We added a fifth pass/fail criterion, namely that an individual could pass/fail the normal performance criterion for either CF or overhead, but not necessarily for both. With these criteria, specificity was in the high range for all AQT measures (87–100%). Sensitivity was

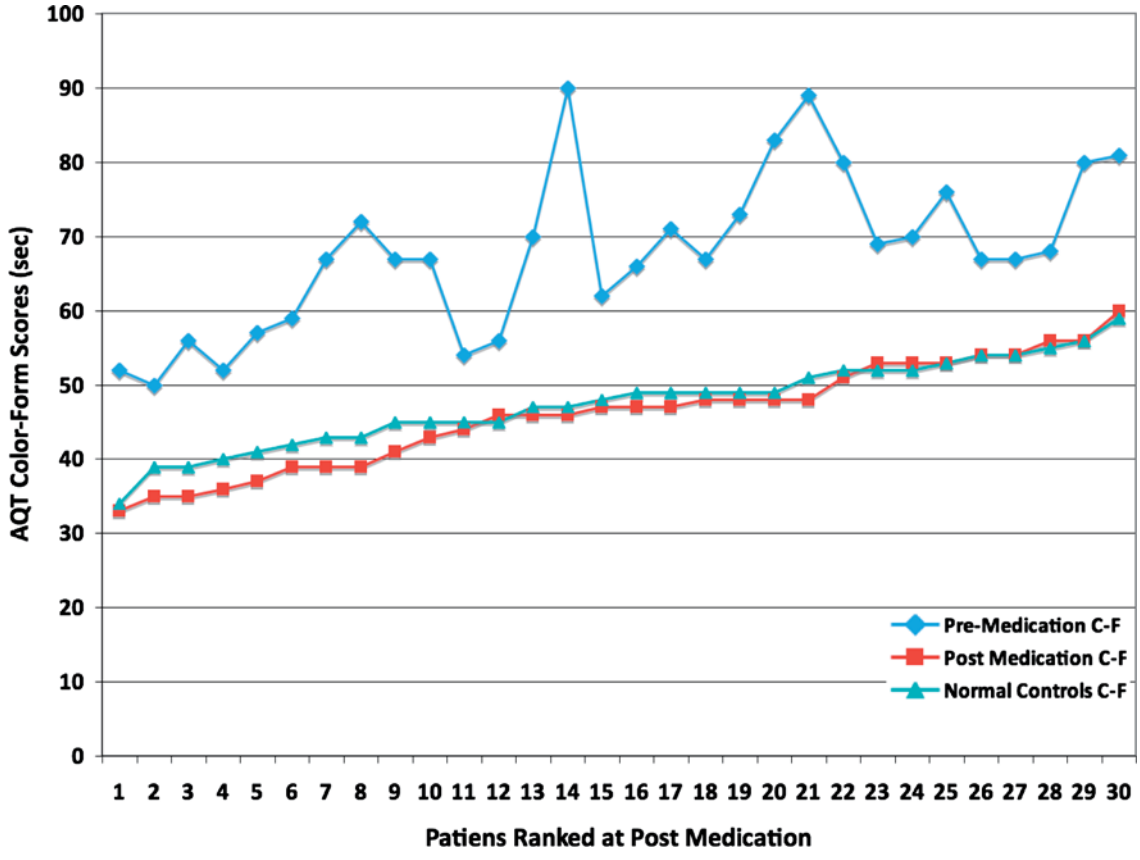

Figure 2. AQT color-form combination naming times (s) for each of 30 adults with ADHD pre- and post-medication with methylphenidate and 30 normal controls.

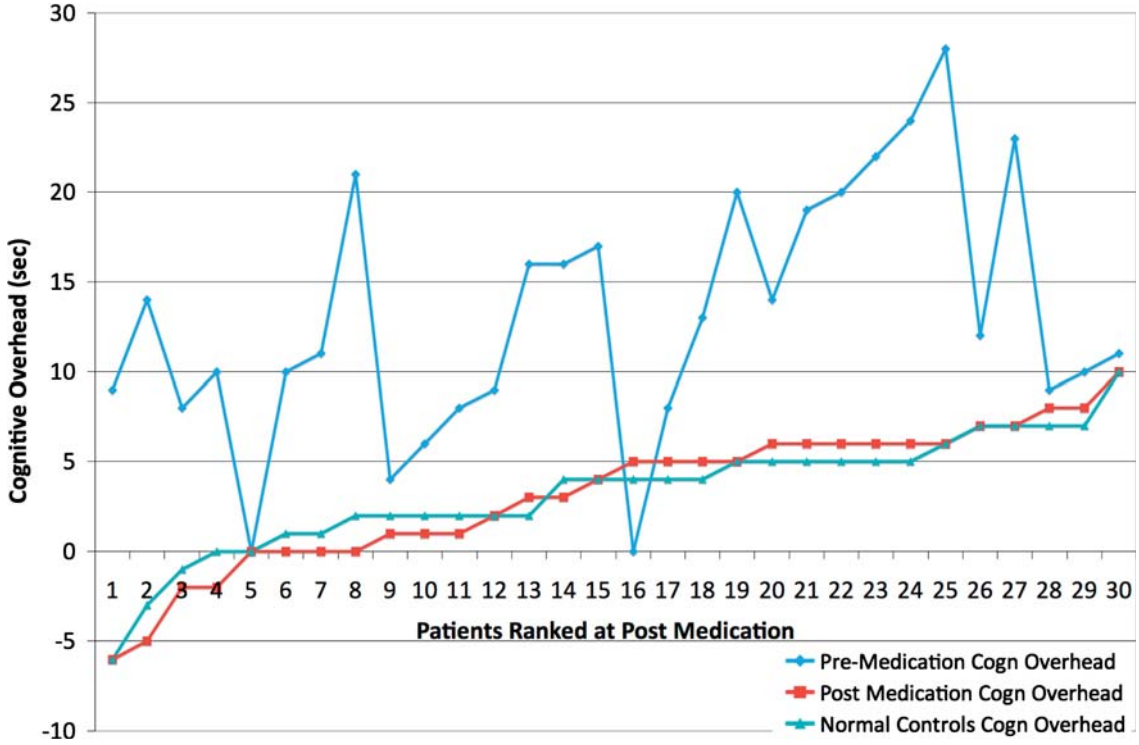

Figure 3. AQT overhead measures [CF – (C + F)] (s) for 30 adults with ADHD pre- and post medication with methylphenidate and 30 normal controls.

low-to-moderate for C, F and CF naming. It was in the moderate-to-high range for the overhead (87%) and for the combined CF or overhead pass/fail criteria (93%).

Discussion

This study has obvious limitations in that the data were collected in an outpatient psychiatric practice, without external funding. The procedures were therefore limited by the requirement to follow prevailing Danish psychiatric practice in a social medicine environment. Due to these limitations, the findings are preliminary and clinical in nature and do not conform to treatment-trial procedures. Another limitation is that existing co-morbidities were not fully evaluated. These and other limitations from the lack of strict control of external factors indicate a need for controlled treatment-trial studies for validation.

Table III. AQT Sensitivity (%) and specificity (%) at pre-medication for 30 adults with ADHD and 30 controls based on norm-referenced criteria for the upper limits of the normal ranges (+1 SD of means).

AQT	Color	Form	Color–Form	Overhead	Color–Form or Overhead
Sensitivity	43	43	73	87	93
Specificity	97	100	100	87	100

We first tested the significance of differences in AQT single- and dual-dimension speed and overhead, as a measure of processing efficiency in an adult ADHD group before and after medication with methylphenidate. Between baseline and stabilization of ADHD symptoms, the ADHD adults experienced significant increases in single- (C and F) and dual-dimension naming (CF) speed, and processing efficiency, as measured by the overhead (O), indicating greater cognitive control. As individuals, all ADHD adults experienced positive effects of medication with methylphenidate (see Figure 1). After stabilization of ADHD symptoms with medication, all ADHD adults exhibited normalized processing and processing efficiency (cognitive control), regardless of the degree of impairment before medication (see Figures 2 and 3). This effect is in agreement with findings that methylphenidate improved naming speed, but not response interference on the Stroop Color Word Test in school-age children with ADHD [29].

Secondly, we compared AQT single- (C and F) and dual-dimension (CF) naming and overhead (processing efficiency) measures in the control group, first with the ADHD group measures at intake without medication and secondly after stabilization of ADHD symptoms methylphenidate. It was unexpected that, before medication, the ADHD adults used significantly longer than the controls to complete single-dimension color and form naming measures. We expected

single-dimension naming speed to be normal in ADHD adults, as it is highly dependent on verbal automaticity that is established in the elementary grades. As hypothesized, at intake without medication the ADHD adults exhibited significantly slower dual-dimension naming speed (CF) and reduced processing efficiency (cognitive control) than their controls. The findings suggest that the ADHD symptomatology affects the quantitative measures of AQT single- and dual-dimension naming speed, but in different degrees. Moreover, impairments of cognitive control in adults with ADHD also had a quantifiable influence on AQT overhead, the measure of efficiency of processing. After stabilization of ADHD symptoms with methylphenidate there were no significant differences in single- or dual-dimension naming speed or processing efficiency between the ADHD and control groups (see Figures 2 and 3). This suggests a normalization of cognitive control in the ADHD group and leads us to assume that in adults with ADHD improved processing speed and lower overhead measures signify a better patient condition. This assumption was supported by psychiatric interviews after stabilization of ADHD symptomatology with methylphenidate. The psychiatric interviews indicated reductions of the core symptoms of ADHD, as well as a decline in substance abuse in those with considerable substance abuse at intake. After stabilization with methylphenidate, patients were referred to community centers for follow-up treatment and therapies.

We also assessed the relations between the AQT single- (C and F) and dual-dimension (CF) naming speed measures and the overhead (efficiency of processing) measure in the ADHD and control group. The associations between AQT single- and dual-dimension naming times were significant, but moderate in degree. This provides behavioral evidence that the AQT single- and dual-dimension naming tests evaluate somewhat different as aspects of processing speed. The association between dual-dimension naming speed (CF) and processing efficiency (overhead) proved low and insignificant for the ADHD adults, and low but significant for the controls. This suggests that in clinical practice, all AQT measures (C, F, CF), including the overhead measure, should be obtained to interpret the extent and nature of impairments in processing speed and cognitive control.

Recent evidence implicates a region of the medial superior parietal lobule as a source of cognitive control during set shifts that is independent of domain and consistent over time [30]. This makes it appropriate to look more closely at the AQT overhead measures of processing efficiency. In the control group, the average overhead was 3.27 s or about 80 ms/stimulus based on 40 stimuli. This is nearly identical to the average overhead of 3.21 s or about 80 ms/stimulus reported for 35–54-year-olds in the study of an additive model for AQT [28]. This small amount may be accounted for by "switch cost" or extra time needed to articulate the names of two stimuli (e.g., red circle). In the group of adults with ADHD, the average overhead was 13.07 s or 330 ms/stimulus before medication. This difference suggests that cognitive control mechanisms located in the parietal lobes, known to be activated in normal adults during AQT color–form combination naming [12,22], were implicated in the adults with ADHD. After stabilization of ADHD symptoms with methylphenidate, the overhead for the group was reduced to 3.20 s or 80 ms/stimulus. This suggests that cognitive control mechanisms were normalized after treatment with methylphenidate.

Sensitivity and specificity evaluated how well each of the AQT processing speed measures differentiated between the adults with ADHD before medication and the controls. The single-dimension naming speed measures (C and F) showed low sensitivity, but high specificity. The sensitivity improved considerably for the dual-dimension naming speed measure (CF), but was only moderate in degree (73%), while specificity stayed high. Sensitivity increased for the overhead measure (87%), but at the same time specificity decreased. Combining dual-dimension naming speed and overhead measures and expecting either one or both to fall above the typical normal range for adults with ADHD and within the normal range for the controls, resulted in the highest levels of sensitivity (93%) and specificity (100%).

The implications for daily life of having adequate and stable attentional control, working memory for visual input and flexibility in shifting set or focus, assessed by the AQT single- and dual-dimension naming speed and overhead measures, are vast. Our findings suggest that AQT may provide a quick, quantitative method for screening for ADHD in general medical practice. We acknowledge that this study has limitations due to its clinical nature, limited sample size, lack of comprehensive, validating psychometric test results, lack of a clinically referred control group without ADHD, and insufficient control of potentially significant variables. We therefore consider the findings preliminary and suggest follow up with clinical studies with greater control of external factors such as substance abuse. Not withstanding these limitations, the AQT processing speed measures provided quantitative data that indicate positive changes in both processing speed and efficiency (cognitive control) with CNS stimulant medication (methylphenidate). The general trend in the ADHD group and the individual measures suggest that a follow-up study of the clinical utility of AQT with placebo treatment and a clinically referred control group without ADHD, strictly controlled variables,

concurrent neuropsychological testing, and assessment of practical daily-life functions may prove of clinical, diagnostic value.

Key Points

- We compared AQT processing speed and efficiency in 30 ADHD adults and 30 age- and sex-matched controls
- AQT single- and dual-dimension naming speed and processing efficiency were significantly reduced in ADHD adults before medication
- AQT single- and dual-dimension naming speed and processing efficiency were restored to normal levels after medication with methylphenidate
- Use of the AQT single-dimension naming speed measures resulted in low sensitivity, but high specificity
- Use of the AQT dual-dimension naming speed and overhead measures resulted in moderate-to-high sensitivity and specificity
- Use of pass/fail criteria for either dual-dimension naming or overhead or both resulted in high sensitivity (93%) and specificity (100%)

Acknowledgements

We express gratitude to patients and controls for participating in this clinical study and to Betina Karin Lassen, Occupational Therapist, for her contributions. This research was not funded by external sources. The authors share part of the royalties for AQT.

Statement of Interest

None.

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