# Effects of a single 10 mg dose of methylphenidate on attention components and executive functions in adults with ADHD: A pilot study

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## Background

Attention deficit/hyperactivity disorder (ADHD) is a common neuropsychiatric disorder in childhood characterized by impulsivity, inattention and hyperactivity. This syndrome affects about 60% of the adults who suffered from ADHD in childhood. Symptoms in adult patients are different such as organization and planning difficulties, procrastination, thoughtlessness, memory troubles. An increasing number of studies investigate the neuropsychology of adults with ADHD. They have been reported to be impaired on different attentional components, perceptual motor speed, working memory, verbal learning and executive dysfunctions.

# **Objective**

Methylphenidate (MPH) is a common off-label treatment. The aim of this pilot study was to assess the neuropsychological effects of a single test dose of MPH (10 mg per os) on different attention components and executive functions by using a computerized test battery. We also analyze if acute effects of a test dose of MPH on cognitive parameters predict long-term outcomes with MPH treatment.

# **Results**



## Material and method

Patients :	15 out-patients (7F / 8M) meeting DSM IV criteria and DIVA 2.0 questionnaire	
Age :	Mean 33 years SD: 10.01 years Range: 19-51	
ASRS scale:	Positive for probable ADHD symptoms	
WURS-25 retrospec- tive scale :	Mean 51.4 (threshold > 46) positive for probable ADHD in childhood	
IQ NART test :	Mean 103.5	





A neuropsychological test battery was performed at baseline and 60 minutes after intake of 10 mg MPH more than two weeks after the baseline in order to avoid possible training effects. Patients were subsequently medicated with an adequate dose of MPH (or extended-release) and followed-up over a period of 6 months (see fig. 2).

Neuropsychological investigation :

Cognitive functions were evaluated by using the computerized attention assessment battery TAP 2.2 (Testbatterie zur AufmerksamkeitsPrüfung, Zimmermann et Fimm, see fig.1). This battery consists in 8 different tasks which were applied as followed: phasic arousal / divided attention / flexibility / incompatibility / go no go test / visual scanning / working memory / sustained attention.

The most relevant parameters were selected for each task and reported in a profile (see fig. 3 & 4). These tests were conducted in both sessions (baseline and treatment).



	Phasic Arousal	0.002
Reaction time	Incompatibility	0.008
	Flexibility	< 0.00001

Statistical results on TAP's relevant parameters: baseline vs single 10 mg dose of MPH (see Fig. 5 and 6)





## Fig. 3 Example of nonresponder patient on TAP profile at baseline (left table) and after a single dose of 10 mg MPH (right table)

AL: phasic arousal; WM3: working memory / difficulty level 3; SA2: sustained attention / shapes and colors; FV3: flexibility / letters - figures; DS3: divided attention / I / aud.-vis.; GO1: Go/Nogo / 2 stimuli; IC: Incompatibility; SC: visual scanning pathological threshold < T 43 (percentile 25).

80 70 80 90 20 30 40 50 60 30 60 10 10 50

**Tasks parameters** 

#### Fig. 5 : Errors and omissions on relevant TAP performances

MTD OM : Working memory omissions; MDT FAU : Working memory falses; AS OM : Sustained attention omissions, AS FAU : Sustained attention falses; BV FAU : Visual scanning falses; BV OM : Visual scanning omissions; INC 1 FAU : Incompatibility (compatible condition) falses; INC 2 FAU : Incompatibility (incompatible condition) falses; FLEX FAU : Flexibility falses; GO FAU : Go no Go falses; AD OM : Divided attention omissions.





## Fig 4. Example of responder patient on TAP profile at baseline (left table) and after a single dose of 10 mg MPH (right table)

### Fig. 6 : Reaction times and standard deviations on relevant TAP performances

APSS X : Phasic attention without signal reaction time mean ; APAV X : Phasic attention with signal reaction time mean; APPSS E : Phasic attention without signal standard deviation; APAV E : Phasic attention with signal standard deviation; INC 1 X : Incompatibility task (compatible condition) reaction time mean; INC2 X : Incompatibility task (incompatible condition) reaction time mean; FLEX X : Flexibility reaction time mean; GO X : Go no Go reaction time mean.

## Conclusion

Adults with ADHD showed neurocognitive benefits after a single 10 mg dose of MPH. Tests assessing working memory, sustained, phasic and selective attention as well as executive functions (flexibility, inhibition control) were significantly improved. Preliminary results indicated that the medication-related positive effects were maintained after regular treatment of adequate MPH over a period of 6 months. Among our patients, 12 who responded positively to the MPH test (see Fig. 4) showed favorable long-terms outcomes with MPH treatment whereas 3 patients considered as non-responders (see Fig. 3) at the MPH test showed no benefits from the MPH treatment. Our preliminary results suggest that the methylphenidate test would be useful in predicting subsequent responses to methylphenidate in ADHD adult patients. Controlled prospective studies are needed to confirm this hypothesis. A higher number of patients and more assessments 6 months after treatment are required. Subjective measurements by using self-rating visual analogical scales will also be included in order to evaluate patient's feelings when treated with methylphenidate. A randomized placebo-controlled design could be proposed in a subsequent study.