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Motor profile of children with attention deficit hyperactivity disorder, combined type

Juliana B. Goulardins [a,b,*], Juliana C. Bilhar Marques [a], Erasmo B. Casella [a], Roseane O. Nascimento [b], Jorge A. Oliveira [b]

[a] Faculty of Medicine of University of São Paulo, Brazil
[b] Laboratory of Motor Behavior, Physical Education and Sports School of University of São Paulo, Brazil

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ABSTRACT

Objectives: The aim of this study was to assess the motor profile of children with attention deficit hyperactivity disorder (ADHD), combined type.
Method: The case group consisted of 34 treatment-naive, male patients, aged 7–11 years, who had been diagnosed with ADHD, combined type, without comorbidities (except oppositional defiant disorder). The control group was composed of 32 age- and gender-matched, typically developing children. The evaluation was made using the Motor Development Scale, which assessed global and fine motricity, balance, body scheme, and spatial and temporal organization.
Results: The results showed that the motor quotients in all areas studied were lower in the ADHD group than in the control group, although in most cases they represent normal values relative to the scale (53% were classified as having "normal medium" motor development, 29% "normal low", 9% "very low", 6% "normal high" and 3% as "lower"). Statistically significant differences between groups were observed in general motor age, general motor quotient, balance, spatial organization, and fine and global motricity.
Conclusion: Difficulties in motor performance were observed in the children with ADHD, combined type. The identification of such deficits may assist in the design of therapeutic protocols for the treatment of children with this type of ADHD.

1. Introduction

Attention deficit hyperactivity disorder (ADHD) is characterized by the inappropriate development of activity level, low tolerance for frustration, impulsivity, distractibility, and the inability to sustain attention and concentration. *Inattentiveness* is the limited ability to remain attentive for the time needed to perform or understand a certain task; *hyperactivity* is characterized by excessive motor activity and impulsiveness in children, and is manifested in sudden and unthinking reactions. Both accompany ADHD (APA, 2000; Barkley, 2003).

ADHD is the most common neurobehavioral disorder during childhood, affecting approximately 3–6% of school-aged children (Polanczyk, Lima, Horta, Biederman, & Rohde, 2007; Rohde & Halpern, 2004). The estimated prevalence of ADHD worldwide is 5.29%. It occurs more often in boys than in girls, and commonly presents comorbidity with other neurological and psychiatric diseases (Barkley, 2003; Polanczyk et al., 2007). A substantial proportion (approximately half) of clinic-referred children with ADHD also are affected by oppositional defiant disorder (ODD) (APA, 2000).

* Corresponding author at: R. Dr Sabóia de Medeiros, 53 apto 23, Vila Mariana, São Paulo – SP, CEP 04120-110, Brazil.
E-mail address: jugoulardins@yahoo.com.br (J.B. Goulardins).

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According to criteria specified in the Diagnostic and Statistical Manual of Mental Disorders, 4th edition, text revision (DSM-IV-TR), ADHD is subdivided into three types: *predominantly inattentive*, *predominantly hyperactive/impulsive*, and the *combined type* (which includes symptoms of both inattention and hyperactivity/impulsivity). The combined type is the most prevalent, and it presents greater impairment to overall functioning than do the other two types (APA, 2000; Rohde & Halpern, 2004).

To date, numerous investigations have described the neurobiological bases of ADHD. Morphometric and neuroimaging studies have identified the brain regions with abnormalities in individuals with this disorder. The main changes found in children are reductions in volume of the prefrontal cortex, the caudate nucleus, the globus pallidus, the anterior cingulate, and the cerebellum, mainly in the vermis and inferior posterior lobe (Berquin et al., 1998; Valera, Faraone, Murrayc, & Seidman, 2007).

Shaw et al. (2007) characterized a delay in the cortical maturation of patients with ADHD by comparing 223 children and adolescents with the disorder, and 223 typically developing children (control group). The aim of this study was to define the trajectory of cortical development using a measure of cortical thickness. The delay was most prominent in the prefrontal regions important to the control of cognitive processes, including attention and motor planning.

Children with ADHD not only display hyperactive motor behavior, but half of them, also, are clumsy when executing motor skills (Pitcher, Piek, & Hay, 2003). Motor problems can have a severe impact on children's daily lives, and occur in 30–50% of children with ADHD (Fliers et al., 2009; Visser, 2003). Unrest, marked by a continuous exchange of activities, can lead to problems with academic performance, and in difficulties with social relations. For example, excessive activities such as unnecessary body movements, impulsivity, anticipating responses, and the inability to wait for particular events can cause learning disabilities and motor disorders, which may result in school failure (Goulardins, 2010; Toniolo, Santos, Lourenceti, Padula, & Capellini, 2009). The aim of the current study, therefore, was to assess the motor profile of children with ADHD, combined type.

2. Materials and methods

2.1. Subjects

A cross-sectional study was conducted on 34 treatment-naive, male patients, aged 7–11 years, with clinical diagnoses of ADHD, combined type, according to classification criteria in the DSM-IV-TR, and without comorbidities, except ODD (comorbidity with ODD was not an exclusion criterion for this study due its high frequency in children with ADHD). These inclusion criteria were chosen in order to maintain homogeneity of the samples. The children were being treated by a multidisciplinary team, and follow-up treatment was being provided in the ADHD Clinic of the Pediatric Neurology Department, Central Institute and Learning Disorders Clinic, Institute for Children, Hospital of the Faculty of Medicine, University of Sao Paulo (HCFMUSP), Brazil.

The control group was composed of 32 age- and gender-matched, typically developing children from public schools. The exclusion criteria were mental retardation; visual, hearing, heart, rheumatic, orthopedic, neurological, and severe behavioral disorders; and regular use of medication.

Written consent was obtained from the parents and/or caregivers of all participants, and the study was approved by the Ethics Committee of the University of São Paulo Faculty of Medicine (no. 0573/08).

2.2. Procedures

Children with ADHD were identified via an initial screening process, in which their teachers and parents were asked to complete the SNAP-IV questionnaire. An expert pediatric neurologist then submitted these children to further assessment, using DSM-IV-TR criteria. From these diagnoses, ADHD types were identified. Once we confirmed the ADHD diagnosis, ADHD subtype, and absence of comorbidities (except ODD), all patients were further assessed by the main researcher. In order to ensure that we selected children for the control group free of symptoms of hyperactivity, impulsiveness, or inattention, we based our inclusion criteria on the information provided by parents in the SNAP-IV questionnaire.

The Motor Development Scale (MDS), described by Rosa Neto (2002), was used to assess fine and global motricity, balance, body scheme, and spatial and temporal organization. The MDS includes specific tasks designed for specific ages, ranging from 2 to 11 years, and complexity increases with age. The MDS provides values for motor ages (averages of test results that are expressed in months) and for motor quotients (motor age in each test, divided by chronological age, and multiplied by 100). The results for motor quotients refer to specific ranges, which classify respective levels of motor development, and which range from "very low" (equal to or below 69 points) to "very high" (equal to or up to 130 points). Positive ages or negative ages are determined by the difference between chronological age and general motor age (Rosa Neto, 2002). All tests were applied during single 40-min sessions.

Statistics were calculated using STATA, version 11.0 (Stata Corporation, College Station, TX, USA), and the level of statistical significance was $p < 0.05$. The Shapiro–Wilks test was used to investigate the framing of numerical variables in a Gaussian distribution. From the results of this test, we found that not all of the variables had numerical parametric distribution. Thus, average values and confidence intervals of 95% (CI 95%) were presented as descriptive statistics.