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Neuropsychological Performance of Adults Evidencing Attention-Deficit Hyperactivity Disorder

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Attention-Deficit Hyperactivity Disorder (ADHD) is no longer believed to be a time-limited syndrome manifested in and restricted to childhood and adolescence. Many of the characteristics associated with the disorder continue in variable form into adulthood. This investigation focused on two measures sensitive to attention, cognitive flexibility, and visual and auditory distraction, to determine if individuals diagnosed with ADHD would perform poorly in comparison with normal control subjects. Forty-two subjects, 27 ADHD adults and 15 control subjects, were administered the Goldman-Fristoe-Woodcock Test of Auditory Discrimination (TOAD), and the Stroop Color and Word Test. The findings indicated that the TOAD Noise subtest significantly discriminated the subjects, resulting in an overall correct classification rate of 80.95%. © 1999 National Academy of Neuropsychology. Published by Elsevier Science Ltd

A pervasive developmental disorder characterized by inattention, restlessness, and impulsivity was first identified by Still (1902). This behavioral constellation has had many diagnostic labels, including, hyperkinesis, hyperactive child syndrome, and minimal brain damage. According to the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV*; American Psychiatric Association, 1994), the essential features of inattention, behavioral disinhibition, and hyperactivity are classified as attention-deficit hyperactivity disorder (ADHD), which affects an estimated 3 to 5% of all children.

ADHD appears to be the most common psychological diagnosis among children in this country. Clinically, it accounts for up to 12 to 36% of the caseload in outpatient clinics depending on diagnostic methodology (Cohen, Riccio, & Gonzales, 1994). Regarding gender, Barkley (1990) reports that ADHD occurs in males roughly three times more often than in girls. However, McGee, Williams, and Silva (1987) suggest that ADHD occurs as frequently in females as in males. They purport that girls may be diagnosed less often because their symptoms are not as blatantly active or aggressive as male subjects.

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It is believed that brain function is impaired to some degree in the child evidencing ADHD. Lou, Henriksen, and Bruhn (1984) established that these children have hypoperfusion in the central white matter of the frontal lobes and in the caudate nucleus relative to the normal perfusion observed in non-ADHD children. Furthermore, the diminished perfusion to the striatum and orbital prefrontal regions is observed more in the right hemisphere than in the left hemishpere (Lou, Henriksen, Bruhn, Borner, & Nielsen, 1989). More recent investigations have documented differences in anatomical mass (Semrud-Clikeman et al., 1994), cerebral volume (Castellanos et al., 1996), glucose metabolism (Zametkin et al., 1990), and hemispheric anomalies (Filipek et al., 1997) in individuals with ADHD. For a comprehensive review of the neurological basis of ADHD, the reader is directed to Riccio, Hynd, Cohen, and Gonzalez (1993).

Consistent with these findings, magnetic resonance imaging (MRI) reveals that the brains of ADHD children do not show the normal frontal asymmetry, with the right being larger than the left (Hynd, Semrud-Clikeman, Lorys, Novey, & Eliopulos, 1990). Instead, ADHD children exhibit a smaller right frontal width, resulting in symmetrical frontal lobes. Other studies examining the neuroanatomy of ADHD have also implicated a right hemisphere dysfunction (Branch, Cohen, & Hynd, 1995; Brumback & Staton, 1982; Heilman, Voeller, & Nadeau, 1991; Schaughency & Hynd, 1989; Semrud-Clikeman et al., 1996; Voeller, 1986). In addition, the right hemisphere has been implicated in other unique tasks relevant to this investigation, such as color identification (Golden, 1978).

In particular, the frontal lobes and related functions are implicated in the symptomology of ADHD (Zametkin et al., 1990). The frontal lobes are considered the area of the brain that controls the executive functions (Luria, 1966; Stuss & Benson, 1986). In addition, behavioral disinhibition, inattention, and restlessness are thought to be associated with impairments in the frontal lobes (Grodzinsky & Diamond, 1992; Lou et al. 1984). Effects of lesions to the frontal lobe often result in a disinhibition syndrome consisting of inappropriate affective responses coupled with the disinhibition of impulses (Luria, 1973; Damasio & Van Hoesen, 1983; Tucker, 1986).

Biederman, Newcorn, and Sprich (1991) reported on the extremely high levels of comorbidity of ADHD among clinical and epidemiological samples. Siedman et al. (1995) hypothesized that comorbidity, familial history, and learning disabilities might affect the pattern and severity of the ADHD symptoms and neuropsychological performance. They found that ADHD children performed at comparable levels on neuropsychological tests with and without the presence of psychiatric comorbidity. Two factors, family history and learning disabilities, were correlated with poorer test performance and outcome in ADHD children. The presence or absence of learning disabilities further complicates the heterogeneous nature of the ADHD population. Barkley (1990) reports a conservative estimate of between 19% and 26% of ADHD children are codiagnosed with at least one type of learning disability. Although the co-occurrence of learning disabilities is not established in the adult population, it is expected that the frequency is comparable to that observed in children (Nadeau, 1995). Several researchers have investigated the comorbidity of ADHD in children with disabilities in reading (Gillis, Gilger, Pennington, & DeFries, 1992; Pennington, Groisser, & Welsh, 1993), visual-spatial abilities (Swanson et al., 1991), language (Cantwell & Baker, 1987), and mathematics (Ackerman, Anhalt, & Dykman, 1986).

In the current diagnostic definition of ADHD, deficits in attentional ability is one of the defining characteristics. Recent investigations have focused on particular aspects of attention, in part to disentangle the influence of behavioral and cognitive factors to ADHD and comorbid conditions. Specifically, auditory attentional abilities have been