

**Sensory-Motor Deficits In Children With Developmental Coordination  
Disorder, Attention Deficity Hyperactivity Disorder And Autistic  
Disorder**

**Piek, J. L., & Dyck, M. J. (2004). Sensory-motor deficits in children with developmental coordination disorder, attention deficit hyperactivity disorder and autistic disorder. *Human Movement Science, 23*, 475-488.**

This article was a critical discussion of relevant literature and the authors' recent research studies in regards to the authors' postulate that deficient sensory-motor functioning in children can aid in detecting the presence or absence of comorbid developmental disorders. The authors investigated the developmental disorders of developmental coordination disorder (DCD), attention deficit hyperactivity disorder (ADHD) and autistic disorder in children. The authors found support for the association of DCD with deficits in visual-spatial processing, kinesthetic perception (particularly related to active movement), and cross-modal integration of kinesthetic information with other sensory information. Research findings on the degree of competency of kinesthetic perception and visual-motor skills in children with ADHD have not been consistent, possibly due to the failure of most researchers to separate the research population of children with ADHD into groups with and without ADHD. Children with ADHD do frequently demonstrate slower processing speed. The motor skill deficiencies in children with ADHD have often been attributed to their distractibility and impulsiveness. These authors investigated this postulate. They found that only children who had comorbid diagnoses of DCD and ADHD had significantly poorer results on a test of fine motor ability than the control subjects and children with only the diagnosis of ADHD. In another study by these authors, they found that children with both diagnoses of DCD and ADHD performed more poorly to a significant degree on measures of visual-spatial organization than the children with ADHD alone or the control group. A meta-analysis done by Pennington and Ozonoff (1996) was stated to indicate that children with ADHD tend to have adequate visual-spatial perception, but have difficulty with executive functioning (e.g., working memory, response inhibition, and planning action sequences). The findings of research studies on children with autism indicate that if both motor coordination and perceptual abilities are markedly deficient, more severe

symptoms are manifested. There has been an association established between difficulties in motor coordination and empathic abilities. Children with DCD may have poor social skills partially due to their inadequate visual-spatial integration contributing to problems in perceiving non-verbal, emotional cues. These authors propose that the presence of a comorbid condition of DCD in some children with autism may be contributing to the severity of impairment in those children.

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SIGN note: This article supports the Ayres' SI principles of deficits in sensory integration contributing to problems in motor coordination, deficits in visual-spatial perception and kinesthetic perception being associated with poor motor skills, and difficulties with sensory processing and motor coordination contributing to problems in social interaction. The article indirectly supports the possible appropriateness of the sensory integrative treatment approach with children having DCD and those having a comorbid diagnosis of autism or ADHD. There was a report of a research finding that children with ADHD tend to have significant difficulty with planning action sequences. This finding also indirectly supports the use of the SI treatment approach with some children with ADHD.

Reviewed by Katherine Inamura, 11/15/2005

**Molloy, C. A., Kietrich, K. N., & Bhattacharya, A. (2003). Postural stability in children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 33(6), 643-652.**

Eight boys identified as having Autism Spectrum Disorder (ASD) and eight controls matched for age, race, and gender took part in this study of postural stability. The subjects with ASD were recruited from children diagnosed or receiving speech therapy at the Kelly O'Leary Center for Pervasive Developmental Disorder of the Children's Hospital Medical Center of Cincinnati, Ohio. They all had a receptive language age of at least 4 years and ranged in age from 7 years to 12 years old. After selection for the study, the boys with ASD were rated on a parent questionnaire concerning their general performance for typical childhood motor activities. Their composite scores for running, climbing, and stair climbing did not vary significantly from the scores given to the controls. Measurements of the postural sway of

the subjects were taken using force platform technology under conditions that removed or changed visual and somatosensory input. In comparison with the neurologically typical controls, the boys with ASD had greater postural sway when vision was occluded and somatosensory information was altered. The subjects with ASD had more difficulty maintaining their upright balance than the controls when vision cues were eliminated, whether or not the somatosensory input was altered or not. The researchers concluded that the study results supported the postulates that children with ASD tend to over-rely on visual information and that they have a deficit in sensory integration rather than a deficit in a particular afferent sensory system.

SIGN note: The study findings seem to support the Ayres' SI postulate that children with ASD have deficits in sensory integration contributing to balance difficulties. However, the study does not provide a link between difficulties in balance and sensory integration to problems in functional activities. It does provide evidence that some children with ASD are over-dependent on visual cues for maintaining their balance. The study is limited by the small number of subjects and the use of an apparently non-standardized questionnaire to assess the presence of motor deficits.

Reviewed by Katherine Inamura, 10/28/2005

**Gillberg, C., & Kadesjo, B. (2003).** Why bother about clumsiness? The implications of having developmental coordination disorder (DCD). *Neural Plasticity, 10, 59-68.*

This article consists of a review of several research studies focusing on a common motor problem currently affecting many school-aged children, called Developmental Coordination Disorder (DCD). More specifically, the authors use past research to create a link between DCD and behavior problems such as ADHD and autism. According to the DSM IV, children with DCD are well below their chronological age or measured intelligence when performing daily activities that require motor coordination, such as handwriting or sports. Researchers trying to uncover the etiology of DCD

have pointed at theories of “processing deficits,” which may cause a reduction in the rate of information processing or create difficulty in handling spatial information that is related to the control of movement. More specifically, researchers have found a greater frequency of visuospatial discrimination impairments and dysfunction of kinesthetic perceptions in children with DCD. In addition, research has shown a high rate of DCD as a comorbid condition in children with ADHD and autism spectrum disorders. In fact, in about fifty percent of all cases ADHD is associated with DCD. Therefore, the authors of this article suggest the need to further study the correlation between these diagnoses. For instance they point to the need to investigate how the treatment of one deficit, e.g. attention, may help alleviate several other problems, e.g. motor control.

**Astill, S., & Utley, A. (2006). Two-handed catching in children with developmental coordination disorder. *Motor Control*, 10(2), 109-124.**

This study investigated the nature and extent of inter and intralimb coupling of the upper limbs in children with developmental coordination disorder (DCD) and their age-matched controls (AMC) when catching a ball two-handed. Sixteen children (8 DCD, 8 AMC) volunteered for the study; parental consent was gained for each child. Using standard video analysis and 3D kinematic analysis, all children were examined performing 30 two-handed catches. Video analysis showed that the AMC children caught more balls than the DCD children ( $p < .005$ ). Analyses of the kinematic data showed DCD participants exhibit a greater degree of linkage both between and within limb than the AMC participants ( $p < .01$ ), but the AMC participants demonstrate more intra individual variability in these linkages ( $p < .01$ ). The data shows that both DCD and AMC children couple their limbs to exert control over redundant degrees of freedom when catching a ball two-handed. However, DCD children show little capacity to vary their motor behavior exhibiting a less adaptable movement system, which in turn affects their success at the task.