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Peer problems mediate the relationship between developmental coordination disorder and behavioral problems in school-aged children

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ABSTRACT

The aim of this study was to gain insights into the relationship between developmental coordination disorder, peer problems, and behavioral problems in school-aged children where both internalizing and externalizing behavioral problems were considered. We assumed that the relationship between developmental coordination disorder and internalizing/externalizing problems in school-aged children is mediated by peer problems and tested the hypothesis that a greater degree of motor impairment causes a greater degree of peer problems and thus a greater degree of internalizing or externalizing problems. Seventy boys and girls aged between 5 and 11 years were examined using the *Movement Assessment Battery for Children 2* and the *Intelligence and Developmental Scales*. The results of path analysis showed that the relationship between developmental coordination disorder and internalizing/externalizing problems in school-aged children is mediated at least in part by peer problems. However, the cross-sectional design of the study does not provide conclusive evidence for a cause–effect relationship and only allows for the conservative prognosis that a greater degree of motor impairment may cause a greater degree of peer problems and thus a greater degree of internalizing/externalizing problems. Nevertheless, the results of this study emphasize the importance of being well-integrated in their peer group especially for children with developmental coordination disorder.

1. Introduction

The child's development depends on the interaction of different functional areas, which can be described by motor, psychological, cognitive, perceptual, linguistic, and social aspects. The particular importance of well-developed motor functions is already evident in early childhood. For instance, the ability to crawl and walk is not only important for the development of other functional skills such as running, hopping, and climbing, but also can positively affect a child's social and cognitive development (Piek, 2006, p. 145). If "Performance in daily activities that require motor coordination is substantially below that expected given the person's chronological age and measured intelligence," the presence of developmental coordination disorder (DCD) is possible (DSM-IV-TR 315.4 A; American Psychiatric Association, APA, 2000, p. 58). However, a final diagnosis of DCD should only be made when the detected performance problems interfere with academic achievements or daily activities and are not due to a general medical condition. Further, "If Mental Retardation is present, the motor difficulties are in excess of those usually associated with it." (see DSM-IV-TR 315.4 B–D; APA, 2000, p. 58).

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According to Magãlhaes, Cardoso, and Missiuna (2011) the most frequently cited motor issues in children with DCD are poor handwriting skills, difficulties in playing ball games and getting dressed.

DCD does not describe a single entity but should rather be understood as a collective term for a variety of different subtypes (Visser, 2003). Especially children with generalized sensorimotor deficits often show comorbid disorders such as attention deficit/hyperactivity disorder (ADHD; Gillberg & Kadesjö, 2000) or reading disability (Kaplan, Wilson, Dewey, & Crawford, 1998). Hence, the statement by Gilger and Kaplan (2001, p. 465) that in the field of developmental disabilities "[. . .] comorbidity [. . .] is the rule rather than the exception" obviously also applies to the field of DCD. Selected theories on comorbidity promise a better understanding of the nature, etiology (recently Moruzzi et al., 2010 versus Loh, Piek, & Barrett, 2011) and the prognosis of DCD (see Visser, 2003). However, to facilitate a comprehensive developmental prognosis and to design effective interventions for children with DCD, it is especially relevant to understand how motor and non-motor problems influence each other in a child's development (e.g., Kastner, Lipsius, Hecking, Petermann, Petermann, Mayer & Springer (2011)Wagner, Kastner, Petermann, Worth, & Bös, 2011) and to identify contextual characteristics that are important for this relation.

Green, Baird, and Sugden (2006) conclude that children diagnosed with DCD generally face emotional and behavioral problems. More specifically, the findings by Dewey, Kaplan, Crawford, and Wilson (2002) indicate that children with DCD show a greater degree of internalizing and externalizing problems compared to typically developing children. Both internalizing and externalizing problems can be considered as subgroups of emotional or behavioral problems. Internalizing behaviors are best characterized as inward-directed, while externalizing behaviors manifest themselves as outward-directed. Indications of internalizing behaviors include a child being depressed or having unfounded fears and phobias or excessive worries. Externalizing behaviors include a child violating societal norms or rules, ignoring teachers' reprimands or being hyperactive (Smith, 2007). The relation between DCD and the different aspects of internalizing and externalizing problems has been studied extensively in the literature. The most significant findings are that DCD is related with higher levels of anxiety (e.g., Pratt & Hill, 2011), depression (e.g., Piek, Bradbury, Elsley, & Tate, 2008) and introversion (e.g., Schoemaker & Kalverboer, 1994) as well as ADHD (e.g., Rasmussen & Gillberg, 2000) and the expression of deviant behaviors (e.g., Kanioglou, Tsorbatzoudis, & Barkoukis, 2005).

In addition to problems in psychosocial adjustment, children with DCD may be at risk for peer relationship problems (Dewey et al., 2002). For instance, children with DCD often spend their recess alone (Bouffard, Watkinson, Thompson, Causgrove Dunn, & Romanow, 1996), generally choose more quiet activities (Jarus, Lourie-Gelberg, Engel-Yeger, & Bart, 2011), show a low engagement in social physical play (Smyth & Anderson, 2000) or organized sports (Magãlhaes et al., 2011) and perceive less enjoyment in daily activities (Bart, Jarus, Erez, & Rosenberg, 2011) as well as less social support (Skinner & Piek, 2001). Especially boys diagnosed with DCD tend to show a low engagement in moderate to vigorous (Green et al., 2011) as well as structured and unstructured (Poulsen, Ziviani, Cuskelly, & Smith, 2007) group physical activities. These findings support the general impression of a poor socialization (Kanioglou et al., 2005) or even social isolation (Smyth & Anderson, 2000) in children with DCD; a phenomenon that appears to remain stable throughout adolescence (Cantell, Smyth, & Ahonen, 1994).

In addition, the meta-analysis by Reijntjes, Kamphuis, Prinzie, and Telch (2010), the randomized controlled intervention study by Witvliet, van Lier, Cuijpers, and Koot (2009) and the short term prospective investigation by Schwartz, McFayden-Ketchum, Dodge, Pettit, and Bates (1998) support the idea that peer problems and internalizing/externalizing problems are closely related.

However, to date the complex relationship between DCD, peer problems and internalizing or externalizing problems is largely unknown. A better understanding of this relationship is important for a more comprehensive developmental prognosis and the development of effective interventions for children with DCD.

The aim of this study was to gain insights into the relationship between DCD, peer problems, and behavioral problems in school-aged children. Both internalizing and externalizing behavioral problems were considered because of their potential co-development and uni-directional (in girls)/bi-directional (in boys) progression shown in a four-year cross-lagged panel study by Lee and Bukowski (2012).

Based on the assumption that development results of a dynamic and action-mediated person-environment interaction (see also Lerner, 1998) and considering the results of the literature, we assumed that the relationship between DCD and internalizing/externalizing problems in school-aged children is mediated by peer problems. We hypothesized that a greater degree of motor impairment causes a greater degree of peer problems and thus a greater degree of internalizing and externalizing problems.

2. Materials and methods

2.1. Sample

Thirty-five children who underwent occupational-therapy[1] (occupational therapy group, OTG; for demographic information see Table 1) and 35 typically developed children matched for age and gender (control group, CG) were included in this cross-sectional study.

[1] At the time of the investigation, the children had received a maximum of five 50-min therapy sessions, where each therapist using their own individual approach.