



## The functional profile of young adults with suspected Developmental Coordination Disorder (DCD)

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### ABSTRACT

We assessed the non-academic and academic functioning of young adults with DCD, and investigated the emotional influences and the role of strategy use within this population. A random sample of 2379 adolescents and young adults aged 19–25 (1081 males [45.4%]; mean age = 20.68,  $SD = 3.42$ ) was used to develop the instruments. From this sample, three study groups were identified ( $n = 429$ ) based on the Adolescents & Adults Coordination Questionnaire: probable DCD ( $n = 135$ ; 67.2% males), suspected borderline DCD ( $n = 149$ ; 51.4% males) and control (145; 70.5% males). Participants completed the Daily Life Functions Questionnaire (assessing non-academic and academic functioning), the Recent Emotional State Test (assessing feelings resulting from task performance), the Internal Factors Attributed to Success Questionnaire and the Problem Solving Questionnaire to assess strategy and executive strategy use. A MANOVA revealed statistically significant differences between-groups ( $F[7,422] = 16.19$ ;  $p < .001$ ;  $\eta = .197$ ); post hoc analyses revealed differences for all measures (except the Problem Solving Questionnaire), with the probable DCD and suspected borderline DCD groups performing worse than controls. Severity of motor deficits was correlated with all outcomes except strategy use. Logistic regression revealed that non-academic functioning was the most significant predictor of group placement ( $B = -1.32$ ;  $p < .001$ ); academic functioning/handwriting was the second most significant predictor ( $B = 0.44$ ;  $p = .047$ ). Deficits in motor coordination continue into adulthood and have an effect on academic and non-academic function, as well as on the emotional state of the individual.

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## 1. Introduction

According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR), Developmental Coordination Disorder (DCD) can be defined based on four criteria: (A) performance in daily activities that require motor coordination is substantially below expected, given the person's chronologic age and measured intelligence; (B) the disturbance in criterion

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A substantially interferes with academic achievement or activities of daily living; (C) the disturbance is not due to a general medical condition (e.g., cerebral palsy, muscular dystrophy), and it does not meet criteria for a pervasive developmental disorder; and (D) if mental retardation is present, the motor difficulties are in excess of those usually associated with it (American Psychiatric Association, 2000).

Individuals with DCD are characterized by limited participation in a range of activities. Their participation limitations may be expressed as difficulties performing gross or fine motor tasks, clumsiness, difficulties with handwriting and drawing, avoidance of sport activities, difficulties with time management, and difficulties in activities of daily living. Moreover, the difficulties are not environment specific and tend to affect the functioning of the individual in a wide range of important environments, including at home and in educational settings (Cermak, Gubbay, & Larkin, 2002; Miller, Missiuna, Macnab, Malloy-Miller, & Polatajko, 2001; Missiuna & Polatajko, 1995; Polatajko, Fox, & Missiuna, 1995).

Since the deficits characteristic of individuals with DCD are so far-reaching, it follows that they may lead to academic, social, behavioral and emotional ramifications that directly influence quality of life (Kaplan, Dewey, Crawford, & Wilson, 2001; Miller et al., 2001; Missiuna & Polatajko, 1995; Segal, Mandich, Polatajko, & Cook, 2002). This has been demonstrated in numerous studies investigating the effects of DCD on children (Cermak et al., 2002; Magalhaes, Cardoso, & Missiuna, 2011; Miller et al., 2001). Mandich, Polatajko, and Roger (2003) interviewed the parents of 12 children with DCD who described their children as suffering from significant difficulties with social participation and activities of daily living as well as reduced self-esteem and self-efficacy. These parents indicated that, as a result of their motor deficits, the quality of life of their children was negatively affected.

In a similar study investigating DCD in children, Engel-Yager and Kasis (2010) assessed 37 children with and without DCD and found that children with DCD exhibited lower self-efficacy than their typical peers. In addition, it was found that children with DCD tend to avoid activities that would expose their coordination difficulties and, as such, demonstrate lower participation in leisure activities. In a different study investigating the leisure activities of 173 children between the ages of 10 and 13, of whom 60 had motor deficits, significant differences were found in the willingness of these children to participate in sports and leisure activities (Poulsen, Ziviani, & Cuskelly, 2008). Moreover, it was found that these children tended to feel lonelier and to engage in shallower social activities than children without DCD. The findings of these studies with pediatric populations reflect how far-reaching the effects of DCD are.

While most of the research literature regarding the sequelae of DCD focuses on kindergarten and preschool-aged children (Cantell, Smyth, & Ahonen, 2003; Kirby, Edwards, Sugden, & Rosenblum, 2010), there has, in recent years, been an increasing awareness of deficits in motor coordination amongst adolescents and adults. Longitudinal studies following children who were diagnosed with DCD at a young age have found that individuals who suffered from this diagnosis as children continued to suffer from motor-coordination deficits in adulthood. However, most of these studies are based on small samples (such as the study of Losse et al. (1991) who assessed 15 adolescents between the ages of 15 and 17, the study of Hellgren, Gillberg, Gillberg, and Enerskog (1993) who assessed ~50 children up to the age of 17 and the study of Rasmussen and Gillberg (2000) who assessed 55 children up to the age of 22).

While the sample sizes may be small, the findings from the existing longitudinal studies seem to imply that the later effects of DCD continue to be far-reaching. For example, Cousins and Smyth (2003) assessed 19 subjects between the ages of 18 and 65 who had been diagnosed in childhood with DCD. Their results showed that the subjects continued to suffer from DCD in adulthood, expressed as slowness, clumsiness and avoidance of daily living tasks such as driving. In addition, the subjects described that their motor coordination deficits had a significant impact on their overall function, including reduced participation in daily tasks and poorer quality of life.

Adolescents with deficits in motor coordination have been found to participate less in complicated activities of daily living and are limited in a range of functions (Mandich et al., 2003). These adolescents have difficulties in performing tasks requiring organization, planning and time management, handwriting, using technical and technological equipment and driving (De-Oliveira & Wann, 2011; Hellgren et al., 1993; Losse et al., 1991; Missiuna, Moll, King, Stewart, & McDonald, 2008; Pereira, Eliasson, & Forssberg, 2000). Kirby, Sugden, Beveridge, and Edwards (2008) assessed how deficits in motor coordination are expressed among students and found significant handwriting difficulties among students with motor deficits as compared to students without deficits in motor coordination. In the same study, students with DCD were also found to have higher requirements for external support.

Mandich et al. (2003) claim that adults with DCD are at higher risk for social, emotional, academic, psychiatric and professional problems. This was evidenced by Kirby et al. (2010), who compared a group of 49 young adults (aged 17–42) with DCD to a group of young adults without motor difficulties. Their findings showed differences between the two groups, most notably in handwriting; the young adults with DCD described difficulty with writing quickly and neatly as compared to the control group. Likewise, the group of young adults with DCD described difficulties with organization and finding objects as well as the avoidance of attending dance clubs as compared to the control group.

In addition to the functional deficits described above, emotional difficulties have also been documented among adolescents with DCD, who are described in the research literature as tending to have lower self-perception and self-esteem in comparison with adolescents without DCD. Moreover, adolescents with DCD describe themselves as having reduced competency and higher levels of anxiety than their peers (Skinner & Piek, 2001). Cantell and Kooistra (2002), in a summary of the nature of DCD among older individuals, argue that further research is essential to explore the emotional and behavioral consequences of DCD.

Together with the expanding body of research regarding the long-term functional and emotional effects of DCD, studies in recent years have also revealed that executive functioning plays an important role in the long-term outcomes of these

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