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The effect of a motor skills training program in the improvement of practiced and non-practiced tasks performance in children with developmental coordination disorder (DCD)

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ABSTRACT

The purpose of the present study was to examine the effect of a group-based task oriented skills training program on motor and physical ability for children with DCD. It was also investigated if there was an effect on fine motor and handwriting tasks that were not specifically practiced during the training program. Forty-one children aged 6–10 years took part in this study. Children were assigned to three groups: an experimental training group consisting of 14 children with DCD, a control non-training group consisted of 13 children with DCD and a control non-training group consisting of 14 typically developed children. The measurements included were, the Movement Assessment Battery for Children (MABC), the Modified Agility Test (MAT), the Triple Hop Distance (THD), the 5 Jump-test (5JT) and the Handwriting Performance Test. All measures were administered pre and post an 8-week training program. The results showed that 10 children of the DCD training-group improved their performance in MABC test, attaining a score above the 15th percentile after their participation in the training program. DCD training-group showed a significant improvement on all cluster scores (manual dexterity (t (13) = 5.3, $p < .001$), ball skills (t (13) = 2.73, $p < .05$) and balance (t (13) = 5.13, $p < .001$). Significant performance improvements were also found in MAT, THD, 5JT (t (13) = –4.55; $p < .01$), handwriting quality (t (12) = –2.73; $p < .05$) and speed (t (12) = –4.2; $p < .01$) after the training program. In conclusion, improvement in both practiced and non-practiced skills, in the training program, may reflect improvement in motor skill but also transfer to other skills.

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1. Introduction

Developmental coordination disorder (DCD) affects 5–6% of school-aged children (APA, 2013) with an additional 15 percent of children considered to be at risk for the condition (Blank, Smits-Engelsman, Polatajko, & Wilson, 2012). The deficits in motor skills associated with this condition not only lead to unsatisfactory performance of daily activities, but may also have a negative impact on psychosocial domains (Skinner & Piek, 2001). Without proper intervention, the problems that arise from DCD may persist into adolescence and adulthood (Summers, Larkin, & Dewey, 2008). Early intervention to enhance motor skills is therefore, important for children with this disorder.

The major treatment approaches that have been used for children with a diagnosis of DCD can be categorized into deficit-oriented and task-oriented interventions (Smits-Engelsman et al., 2012).

Task-oriented approaches such as neuromotor task training (NTT; Niemeijer, Schoemaker, & Smits-Engelsman, 2006) and imagery training (Wilson, Patrick, Thomas, & Maruff, 2002) are based on a combination of current motor control, motor learning and ecological principles (Sudgen & Dunford, 2007). Task-oriented approach focuses on teaching functional tasks without an emphasis on the underlying process (Au et al., 2014). Functional skills, that are essential in daily life, are trained. Over the course of the program, both the task and environmental context are modified so as to increase the challenge posed to the child. The Neuromotor Task Training program, which is a task-oriented approach, has especially been developed for children with DCD, and some positive results were reported (Niemeijer, Smits-Engelsman, & Schoemaker, 2007). NTT has shown positive outcomes and reported improvements in handwriting ability (Jongmans, Smits-Engelsman, & Schoemaker, 2003) and motor performance (Niemeijer et al., 2007) in children with DCD. Apart from two studies (Jongmans, Linthorst-Bakker, Westenberg, & Smits-Engelsman, 2003; Ferguson, Jelsma, Jelsma, & Smits-Engelsman, 2013) treatment using NTT was not given in a group. Group-based training may be the preferred treatment option due to the associated cost savings and produced similar gains in motor performance to individual-based training (Hung & Pang, 2010). In addition, most parents preferred a group-based exercise program, rather than an individual-based one (Au et al., 2014). Both individual and group programs have been shown to be effective ways of teaching motor skills and essential activities of daily living and, thereby, stimulate participation at home, at school, in leisure, and sport activities in children with DCD (Ferguson et al., 2013; Smits-Engelsman et al., 2012; Sugden, 2007).

Studies attempting to characterize the deficiencies in children with DCD have demonstrated that these children's motor performance is consistently slower, less accurate, less precise, and less consistent than that of their peers (Ferguson, Jelsma, Versfeld, & Smits-Engelsman, 2014; Smits-Engelsman, Wilson, Westenberg, & Duysens, 2003). Indeed, children with DCD are identifiable by the difficulties they have in performing fine and gross motor tasks (Schott, Alof, Hultsch, & Meermann, 2007). Likewise, findings suggest that children with lower motor competence demonstrated also significantly poorer performance on important components of physical fitness, such as aerobic and anaerobic endurance and muscular strength, than their peers who are developing typically (Ferguson, Aertssen, Rameckers, Jelsma, & Smits-Engelsman, 2014). Several studies (Haga, 2008; Schott et al., 2007) have demonstrated that children with DCD produce significantly lower levels of maximum force and are less powerful when compared to their typically developing peers. Moreover, studies provided evidence to support the theory that strength and power may be one of the underlying that contribute to motor difficulties in children with DCD (Haga, 2009; Van der Hoek et al., 2012). Likewise, results from functional performance tasks such as sprinting, hopping, and jumping, have also reported lower levels of explosive power in children with DCD (Raynor, 2001). Children who received the NTT intervention showed significant improvements in functional strength outcomes. The tasks in the functional strength measure emphasize different aspects of muscle function such as endurance, strength and power (Smits-Engelsman & Verhoef-Aertssen, 2012).

However, it is not known whether decreased physical abilities (muscle power, explosive strength and agility) are primary or secondary for children with DCD. Although many different intervention strategies have been studied, it remains still unclear, which are better able to improve motor performance in children with DCD and alleviate the associated problems. In this context, Hung and Pang (2010) have shown motor skill training (MST) to be a promising treatment option for children with DCD. During NTT, regular engagement in physical activity is associated with a variety of psychological and physical benefits for children (Schoemaker, Niemeijer, Reynders, & Smits-Engelsman, 2003). This is important because the perceived enjoyment of an activity is one of the determinants of physical activity. Cairney et al. (2012) showed that motivation to participate in physical activity in children is influenced by perceptions of physical activity as fun, interesting and challenging.

Literature highlights that DCD negatively affects the child's participation in the classroom with handwriting difficulties being of particular concern (Kirby, 2011). Furthermore, handwriting assessment is required among children with DCD for a variety of reasons, including evaluation of intervention efficiency (Dunford, Street, O'Connell, Kelly, & Sibert, 2004). Jongmans, Smits-Engelsman et al. (2003) indicated progress in handwriting abilities in children with DCD that were trained in a group based handwriting NTT program.

Nowadays, individual-based training is a frequently used approach, in which children with DCD receive one-on-one training from a therapist (Niemeijer et al., 2007). Group-based training may be an appealing alternative approach if it can be proved to produce similar, if not better outcomes (Ferguson et al., 2013). A review of the literature revealed a lack of evidence with respect to the use of a group based gross motor skills training program that focuses on improving coordination as an effective intervention for children with DCD (Smits-Engelsman et al., 2012). NTT could be the therapy of choice because in this approach, therapists implement functional exercises that tap the specific motor control aspect that is considered the