Research in Developmental Disabilities 35 (2014) 3148–3155

Contents lists available at ScienceDirect

Research in Developmental Disabilities

Similarities and dissimilarities between the Movement ABC-2 and the Zurich Neuromotor Assessment in children with suspected developmental coordination disorder

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ARTICLE INFO

Article history:
Received 28 March 2014
Received in revised form 29 July 2014
Accepted 30 July 2014
Available online 23 August 2014

Keywords:
Movement Assessment Battery for Children
Zurich Neuromotor Assessment
Developmental coordination disorder
Motor coordination
Movement skills
Motor abilities

ABSTRACT

An established tool for the assessment of motor performance in children with developmental coordination disorder (DCD) is the Movement-ABC-2 (M-ABC-2). The Zurich Neuromotor Assessment (ZNA) is also widely used for the evaluation of children's motor performance, but has not been compared with the M-ABC-2. Fifty-one children (39 males) between 5 and 7 years of age with suspected DCD were assessed using the M-ABC-2 and the ZNA. Rank correlations between scores of different test components were calculated. The structure of the tests was explored using canonical-correlation analysis. The correlation between total scores of the two motor tests was reasonable (0.66; $p < 0.001$). However, ZNA scores were generally lower than those of M-ABC-2, due to poor performance in the fine motor adaptive component and increased contralateral associated movements (CAM). The canonical-correlation analysis revealed that ZNA measures components like pure motor skills and CAM that are not represented in the M-ABC-2. Furthermore, there was also no equivalent for the aiming and catching items of the M-ABC-2 in ZNA. The two tests measure different motor characteristics in children with suspected DCD and, thus, can be used complementary for the diagnosis of the disorder.
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1. Introduction

Developmental coordination disorder (DCD) is one of the most common developmental disorders in school age children with an estimated prevalence rate between 5% and 6% (Blank, Smits-Engelsman, Polatajko, & Wilson, 2012; Zwicker, Missiuna, Harris, & Boyd, 2012). The motor difficulties occur as poor balance and clumsiness and as an impairment to learn

Abbreviations: AC, aiming & catching; BA, balance; BOT-2, Bruininks-Oseretsky Test of Motor Proficiency; CAM, contralateral associated movements; DB, dynamic balance; DCD, developmental coordination disorder; MD, manual dexterity; FM, fine motor adaptive; M-ABC-2, Movement Assessment Battery for Children–Second Edition; PM, pure motor skills; SDS, standard deviation scores; SB, static balance; ZNA, Zurich Neuromotor Assessment.

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http://dx.doi.org/10.1016/j.ridd.2014.07.062
0891-4222/© 2014 Published by Elsevier Ltd.

motor skills such as catching, throwing, running, jumping, hopping, cutting and handwriting (Blank et al., 2012; Pieters, De Block, Scheiris, Eyssen, & Desoete, 2012). The European Academy of Childhood Disability recently published clinical practice guidelines for the definition, diagnosis, assessment and intervention for children with DCD (Blank et al., 2012). Furthermore, in 2013 the Diagnostic and Statistical Manual, 5th edition–Text revision (DSM-V-TR) was released where distinct diagnostic criteria were defined (American Psychiatric Association, 2013). However, the aetiology of the disorder is still unknown (Wilson, Ruddock, Smits-Engelsman, Polatajko, & Blank, 2013; Zwicker, Missiuna, & Boyd, 2009; Zwicker et al., 2012). What becomes clear from the literature is that DCD can manifest itself with a great variety of motor coordination difficulties. Some children may have problems with gross motor skills; others show only fine motor problems or just perform very slowly on various motor tasks.

According to DSM-V-TR four diagnostic criteria define DCD: (A) the performance in daily activities that require motor coordination is substantially below expected levels given age and intelligence; (B) the disturbance interferes with academic achievements or daily activities; (C) the disorder cannot be attributed to a medical condition and (D) the motor difficulties are not related to mental retardation (American Psychiatric Association, 2013). Thus, a test instrument for the diagnostic purpose of DCD must specifically address criterion A.

There are a number of motor tests available for the assessment of children with motor difficulties (Bruininks & Bruininks, 2005; Folio & Fewell, 2000; Henderson, Sugden, Barnett, Petermann, & Bös, 2007; Largo, Rousson, Caflisch, & Jenni, 2007; Venetsanou, Kambas, Ellinoudis, Fatouros, & Giannakidou, 2011). The recently published clinical practice guidelines for DCD specifically recommend the Movement ABC-2 (M-ABC-2) (Henderson et al., 2007) and the Bruininks-Oseretsky Test of Motor Proficiency (BOT-2) (Bruininks & Bruininks, 2005) as appropriate instruments to support the diagnosis of the disorder (Blank et al., 2012). Some health care professionals also routinely use the Zurich Neuromotor Assessment (ZNA) (Largo et al., 2007) battery for the evaluation of children with motor problems or those who are at risk of developmental disturbances, for example preterm children (Seitz, Jenni, Molinari, Caflisch, & Largo, 2006). In contrast to the M-ABC-2, which was specifically developed to identify children with movement difficulties, the ZNA was designed to assess the entire range of a child's motor performance from high to low achievers (Largo, Caflisch, Hug, Muggli, & Molnar, 2001a,b; Largo et al., 2007). Over the past years, several papers have been published which assessed the test-retest, inter-observer and intra-observer reliability (Rousson, Gasser, Caflisch, & Largo, 2008) and the validity of the ZNA (Schmidhauser, Caflisch, Rousson, Bucher, & Largo, 2006; Seitz et al., 2006), presented age-related normative values (percentiles) (Largo et al., 2001a,b) and calculated intra-individual stability measures from 6 to 18 years of age (Jenni, Chaouch, Locatelli, Thoeni, & Diezi, 2011).

The M-ABC-2 is the most widely used test in children with motor problems, but a gold standard to identify DCD is still lacking (Crawford, Wilson, & Dewey, 2001). Because DCD is a common disorder in childhood (American Academy of Pediatrics, 2001), it is important to assess whether alternative tests, such as the ZNA, may also help to detect children with DCD and how their results compare with those of the M-ABC-2. Thus, the aim of this study is to describe similarities and dissimilarities between the ZNA and the M-ABC-2, to examine whether the two instruments identify the same children with suspected DCD and to evaluate the usefulness of the ZNA for the diagnosis of the disorder. In this context the comparison of two different motor tests may be instructive regarding the various deficits of DCD with different neural correlates (Darsaklis, Snider, Majnemer, & Mazer, 2013; Wilson et al., 2013; Zwicker et al., 2009, 2012).

2. Method

2.1. Sample selection

In total, 51 children (39 boys) between 5 and 7 years of age (median: 6.0 years, inter-quartile range: 5.7–6.4 years) were selected from the waiting list of the Center for Psychomotor Therapy of the city of Zurich (*Fachstelle Psychomotorik-Therapie*). Teachers referred children to the Center for Psychomotor Therapy if they showed gross or fine motor problems in the kindergarten or school setting; the children were rated by the teacher as noticeably clumsier in comparison to their peers and were impaired in activities of daily living. Children with behavioural problems, intellectual impairment or neurological disorders were not considered for the study.

The study was approved by the institutional review board of the Canton of Zurich and conformed to the Declaration of Helsinki. All the families received a study description and provided informed written consent.

2.2. Assessment tools which were compared: M-ABC-2 and ZNA

2.2.1. Movement ABC-2 (M-ABC-2)

The M-ABC-2 is a norm-referenced test and most frequently used for diagnostic purposes of DCD (Smits-Engelsman, Blank, van der Kaay, Mosterd-van der Meijs, & Vlugt-van den Brand, 2013). The revised version is subdivided into 3 age bands (3 years 0 months–6 years 11 months; 7 years 0 months–10 years 11 months; 11 years 0 months–16 years 11 months) and scores motor performance on three main components: manual dexterity (MD), aiming & catching (AC) and balance (BA). The first M-ABC-2 age band (which was used in this current study, 3 years 0 months–6 years 11 months, see also Table 1) contains 8 performance items: posting coins (time), threading beads (time), drawing trail (number of errors), catching beanbag (number of correct catches), throwing beanbag onto mat (number of correct hits), one-leg balance (time), walking heels raised (number of steps) and jumping on mats (number of jumps) (Henderson et al., 2007).

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