Human Movement Science 53 (2017) 45–54

Contents lists available at ScienceDirect

Human Movement Science

journal homepage: www.elsevier.com/locate/humov

Full Length Article

Ecological validity of the German Bruininks-Oseretsky Test of Motor Proficiency – 2nd Edition

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ARTICLE INFO

Article history:
Received 20 February 2016
Revised 4 October 2016
Accepted 9 October 2016
Available online 7 November 2016

Keywords:
Bruininks-Oseretsky Test of Motor Proficiency
BOT-2
German
DCD
Daily activities
Validity
Parents

ABSTRACT

The diagnosis of Developmental Coordination Disorder (DCD) is based on poor motor coordination in the absence of other neurological disorders. In order to identify the presence of movement difficulties, a standardised motor assessment is recommended to determine the extent of movement problems which may contribute to deficits in daily task performance. A German version of the Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (German BOT-2) was recently published. This study aimed to determine the ecological validity of the German BOT-2 by considering the relationship between assessment of fundamental motor skills with the BOT-2 and performance of everyday motor activities as evaluated by parents. This study used data obtained from the German BOT-2 standardisation study (n = 1.177). Subtests were compared with theoretically corresponding tasks via parental ratings of overall fine and gross motor abilities and performance in six typical motor activities. Non-parametric Jonckheere Terpstra test was used to identify differences in ordered contrasts. Subtests reflecting 'Strength', 'Running Speed and Agility', 'Upper-Limb Coordination', 'Balance', and 'Fine Motor Precision' were associated with parental evaluation of gross motor skills ($p < 0.001$). The subtest 'Fine Motor Integration' significantly correlated with parental ratings of females' fine motor skills. Parental ratings of males' fine motor skills were associated with three further subtests. Regarding everyday motor activities, the first three fine motor BOT-2 subtests were associated with parent evaluations of drawing, writing and arts and crafts ($p < 0.001$). Gross motor subtests of 'Bilateral Coordination' and 'Balance' showed no relationship to bike riding or performance in sports. Subtests of 'Upper-Limb Coordination' and 'Strength' showed significant correlations with sports, ball games and cycling. The results of this study suggest that the closer the proximity in the nature of the motor skills assessed in the German BOT-2 to daily motor tasks, the stronger the relationship between the clinical test and parental report of everyday performance of their child. The body functions tested in the German BOT-2, and hypothesized to underpin certain skills, were not automatically relevant for specific activities undertaken by German children. Future research should investigate the relationships of the various BOT-2 constructs for diagnosis of DCD.

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http://dx.doi.org/10.1016/j.humov.2016.10.005
0167-9457/

1. Introduction

The daily life of a child is full of activities which require different motor demands such as drawing, cutting, dressing and playing ball. Fundamental motor skills are typically mastered during childhood through play and participation in daily activities. However skill acquisition may be influenced by personal and environmental factors enabling opportunities for participation and practice within an individual's everyday performance (Cools, Martelaer, Samaey, & Andries, 2009; Foweather, 2010; Kakebeeke et al., 2013).

Still, there are children who have persistent problems with the achievement and engagement in everyday activities due to movement impairments. Despite average intelligence and the absence of other medical or developmental conditions, children with Developmental Coordination Disorder (DCD) have difficulty acquiring and performing typical motor based tasks (American Psychiatric Association, 2013; World Health Organisation, 1992). Children with DCD present difficulties across all levels of the International classification of functioning, disability and health (ICF) (World Health Organisation, 2001): body functions/structures, activities and participation (Magalhaes, Cardoso, & Missiuna, 2011; Wilson, Ruddock, Smits-Engelsman, Polatajko, & Blank, 2013). Children with DCD have also been reported to be at higher risk of additional problems, including poor self-efficacy, psychosocial problems (Green, Baird, & Sugden, 2006; Missiuna, Moll, King, King, & Law, 2007) and overweight and obesity (Joshi et al., 2015). Finally, movement difficulties and their impact on daily task performance may persist into adulthood (Kirby, Williams, Thomas, & Hill, 2013; Tal-Saban, Ornoy, & Parush, 2014). Due to the extensive nature and consequences of coordination difficulties, early diagnosis of DCD is important. Early diagnosis may help to determine and implement appropriate intervention and offset potential negative impacts.

Current evidence-based guidelines for the diagnostic process of DCD recommend assessment of motor skills (Criterion A) as well as impact on activities and participation (Criterion B) (Blank, Smits-Engelsman, Polatajko, & Wilson, 2012). To verify criterion A, it is recommended to use a valid, standardised, objective and norm referenced test to determine any limitations in motor skill (Blank et al., 2012). The Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2) (Bruininks & Bruininks, 2005) is recommended within current guidelines for DCD. The BOT-2 has recently been adapted and standardised for German speaking countries (German BOT-2) and normative values have been derived (Blank, Jenetzky, & Vinçon, 2014). In contrast, Criterion B requires identification of performance in everyday activities involving motor skills. However, the clinical utility of assessing performance across multiple environmental domains is restricted. Thus parent and teacher reports, via questionnaires and checklists, are more frequently used as these are able to focus on the child's activities and participation within individual contexts (Green et al., 2005).

The degree to which test performance corresponds to real-world everyday performance represents ecological validity (Chaytor & Schmitter-Edgecombe, 2003). Two approaches have been conceptually defined to address the ecological validity of assessment instruments: verisimilitude and veridicality, reflecting the theoretical resemblance and empirical relationship of the test to everyday functioning respectively (Chaytor & Schmitter-Edgecombe, 2003). Identifying the ecological validity of movement skill assessments is important as we move away from purely diagnostic questions, especially in considering the impact on activity performance and participation in order to suitability plan intervention programmes.

Motor assessments aim to provide information about overall movement capacity as well as specific motor areas. From the perspective of the ICF, assessments of motor skills of children (Criterion A), predominantly focus on fundamental skills (e.g. balance) or activities (e.g. throwing and catching) (Darsaklis, Snider, Majnemer, & Mazer, 2013). With respect to the BOT-2, the general construct of motor proficiency is divided into four broad motor composites of 'Fine Manual Control', 'Manual Coordination', 'Body Coordination' and 'Strength and Agility' with two subtests in each composite and 53 items in total (Bruininks & Bruininks, 2005).

Standardised assessments of motor skills, while allowing for reliable replication to determine the relative risk of poor skills in comparison to age and gender related norms, potentially lack cultural validity. Items such as stringing blocks or walking forward on a line may have little relationship to real life activities in which motivations and situations of children differ (Brown & Chien, 2010; Kennedy, Brown, & Chien, 2012). This raises questions regarding the extent to which a standardised test situation and subsequent results can be considered ecologically valid and thus representative of the skills required for performance in daily life activities of children. This has particular resonance for the diagnosis of DCD in which the functional deficits of Criterion B are due to the movement impairments of Criterion A (American Psychiatric Association, 2013; Blank et al., 2012).

For a diagnosis of DCD, the results of the standardised test, must be interpreted in the context of the skills demonstrated by the individual child in his or her daily life. In considering the relevance of a test result, parents often have the best perspective of their child's abilities, providing external report in order to meet Criterion B (Gaines & Missiuna, 2007; Glascoe & Marks, 2011; Green et al., 2005). Parental view, garnered over time and across environmental contexts, may thus offer an ecological perspective which could be considered in conjunction with standardised assessments.

Previous studies have compared standardised motor assessment to parent evaluations with equivocal results. Kennedy et al. (2012) found, in a small sample of 38 typical developing (TD) school-aged children, significant correlations between the BOT-2 Total Motor Composite and three of the four composites (excluding 'Fine Manual Control'), and the Movement Assessment Battery, Second Edition (MABC-2) checklist completed by parents. In contrast, Brown and Lane (2014), with 50 TD children over a broader age range (7 to 16 years), found the BOT-2 composite 'Fine Manual Control' as well as 'Manual Coordination' to be moderately correlated with parent report on the MABC-2 checklist, whereas the two gross motor related