



Review article

A review of five tests to identify motor coordination difficulties in young adults



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ABSTRACT

Difficulties with low motor competence in childhood and adolescence, such as that seen in Developmental Coordination Disorder (DCD), often persist into adulthood. Identification of DCD at all ages is particularly challenging and problematic because of the diversity of motor symptoms. Many tests of motor proficiency and impairment have been developed for children up to 12 years of age. Whilst identification of DCD is important during childhood, it is of equal importance to identify and monitor the impact of this impairment as an individual grows and develops. Currently there is no test specifically designed to support diagnosis and monitor change in the age range 16–30 years. In this article we review five tests that have been used to assess motor competence among young adults (Bruininks–Oseretsky Test of Motor Proficiency-2, McCarron Assessment of Neuromuscular Development, Movement Assessment Battery for Children-2, Tufts Assessment of Motor Performance and the Zurich Neuromotor Assessment). Key issues relevant to testing motor skills in older populations, such as the inclusion of age appropriate skills, are explored. While the BOT-2 provided the most evidence for valid and reliable measurement of Criterion A of the diagnostic criteria for DCD among this age group, no test adequately evaluated Criterion B. Further evaluation of motor skill assessment among the young adult population is needed.

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1. Introduction

Poor motor proficiency has been researched extensively, particularly in those diagnosed with Developmental Coordination Disorder (DCD), a condition characterised by the inability to execute movement skills at an age appropriate level (American Psychiatric Association (APA), 2013). Whilst the majority of research has concentrated on motor impairment within the childhood period, studies have shown that motor coordination problems often persist into adolescence and beyond (Cantell, Smyth, & Ahonen, 1994; Cousins & Smyth, 2003; Hellgren, Gillberg, Gillberg, & Enerskog, 1993; Kirby, Edwards, & Sugden, 2011; Losse et al., 1991; Missiuna, Moll, King, Stewart, & Macdonald, 2008). The testing of motor impairment, or poor coordination, from mid adolescence to adulthood is a relatively new area of interest, so there is only a limited understanding of the presentation of motor impairment in adulthood, what aspects persist or resolve, and how it impacts a person's life as they mature and age. In the recent edition of the DSM-5 (American Psychiatric Association, 2013) information about DCD among adolescents and adults was included for the first time. It appears that many health and psychosocial issues may become more profound with age in individuals who are reported to have fewer social skills, experience poorer social support, reduced participation in many social and sporting activities, reduced employment opportunities, and have higher anxiety and lower self-worth (Cantell, Crawford, & Doyle-Baker, 2008; Clark & Whittall, 2011; Kirby, Williams, Thomas, & Hill, 2013; Missiuna et al., 2008; Skinner & Piek, 2001; Tal-Saban, Ornoy, Grotto, & Parush, 2012; Tal-Saban, Zarka, Grotto, Ornoy, & Parush, 2012). It is therefore important that age appropriate assessment tools be made available so that DCD can be identified and monitored throughout life.

Most tests of motor proficiency and impairment have been developed for children up to 12 years of age (Cools, De Martelaer, Samaey, & Andries, 2009; Slater, Hillier, & Civetta, 2010; Wiart & Darrah, 2001; Yoon, Scott, Hill, Levitt, & Lambert, 2006). Despite this, some have been used to assess motor performance in adolescents or adults. Researchers have also used assessments which have been standardised for use with younger children (Losse et al., 1991; Sahlender, Mattsson, & Bejerot, 2008), adapted motor tasks to make them more difficult (Cantell, 1998; Cousins & Smyth, 2003), used individual perceptual-motor tasks (Porter & Corlett, 1989), used a combination of a neuro-developmental examination and neuropsychiatric tests (Hellgren et al., 1993; Rasmussen & Gillberg, 2000), self-report questionnaires (Kirby, Sugden, Beveridge, & Edwards, 2008), or a childhood diagnosis of DCD (Hill & Brown, 2013) to assess adolescents or adults. In most instances, the modifications of assessments have not been validated with an older age group. Their use creates the potential for those with motor difficulties to achieve high scores on tests designed for younger children (ceiling effect) or to be disadvantaged by being assessed with test items developed for smaller bodies. For example, large hands may find it harder to manipulate small objects or access items in small boxes. Either way, many adolescents and adults with movement difficulties remain undiagnosed or misdiagnosed and, as a result, most likely unsupported by their family and allied health services.

In order to better identify and support adults with motor impairments, we need assessment tools specifically designed for this age group. The purposes of this paper were to identify and review assessments used for the identification of motor impairment beyond the childhood period and identify how the assessment and identification of motor impairment may need to differ for adults compared to children.

2. Implications for assessing motor proficiency among adults

Unlike kinematic variables such as reaction and movement time which change with age (e.g., Hodgkins, 1962), motor abilities are considered trait-like attributes based on underlying neuromotor processes of an individual and are not expected to change considerably with age (Burton & Rodgerson, 2001). On the other hand, motor skills are more goal-directed patterns such as walking, running or kicking that may be modified or improved with practice and experience (Burton & Rodgerson, 2001). Therefore, scores achieved on tasks that assess trait-like motor abilities may be less likely to change between childhood and adulthood than skill-related test items. In order to identify motor difficulties in the older age group it is important to understand which types of tasks are most likely to detect varying forms of impairments. However, few studies have examined if, and how, the type or degree of motor impairment may change with age.

We suggest that the degree of motor skills impairment may reduce or change in adulthood for a number of reasons. First, many structural changes, particularly at the musculo-skeletal and neurological level, continue to occur post puberty which may have implications for the measurement of motor skills. For example, performances in strength related tasks such as vertical jump, standing long jump and sprint run continue to improve, particularly in males, in the mid to late teens (Blanksby, Bloomfield, Ackland, Elliott, & Morton, 1994). At the neurological level, some regions of the brain continue to develop well into early adulthood (Giedd, 2004). Sowell et al. (1999, 2003) found increased white matter densities in the

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