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Original article

Study of clinical characteristics in young subjects with Developmental coordination disorder

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Abstract

Background: Developmental Coordination Disorder (DCD) is a chronic neurological disorder observed in children. DCD is characterized by slowness in activities and motor impairment that affects the children's daily living and academic achievements, and later their professional and social behavior. Our aim in this work was to report characteristics frequencies in a group of children with DCD and to propose a subtyping of DCD characteristics.

Methods: Thirty three clinical DCD characteristics, the mostly reported in the literature, were assessed in 129 patients, boys and girls aged from 4 years to 18 years, and their subtyping was proposed. The statistical analyses were carried out with the Chi square, the t-test and the correlation for the statistical differences, and with the Ward clustering method for subtyping.

Results: We found that there were 3.17 boys for one girl, all patients were characterized as slow, 47% were left-handers or ambidextrous, 36% and 26% had orofacial and verbal dyspraxia, respectively, 83% were found anxious, and 84% were described as being clumsy.

Conclusions: It appears from these results that a child with DCD expresses more than a single difficulty. Three subtypes emerged from the statistical analysis in this study: (1) clumsiness and other characteristics except language difficulties; (2) self-esteem and peer relation without clumsiness and language difficulties; (3) language difficulties and orofacial dyspraxia.

Keywords: Developmental Coordination Disorder; Dyspraxia; Neurological disorders; Brain development

1. Introduction

Developmental Coordination Disorder (DCD) is a chronic neurological disorder affecting children and persisting in adulthood [1–6]. DCD affects nearly 6% of the school age population. It is reported as impairment in motor skill with consequences in everyday life and academic achievements [1,2]. Several manifestations are observed in children with DCD, such as clumsiness, handwriting difficulties, gait and balance, motor planning deficiency and fine motor delay or difficulties. Magalhaes et al. reviewed 319 publications between 1995 and 2005 on DCD and reported that more than 9 terms were used to define DCD in several countries and across several disciplines such as medicine, education and psychology [7].

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DCD is now recognized as an existence of motor difficulties without any other impairment affecting motricity in children. Since 1994, DCD is consensually defined and reported in the Diagnostic and Statistical Manual of Mental Disorders, updated in the latest version (DSM-5) with the definitions in four characteristics [8].

1.1. Frequently reported DCD characteristics

Barnett et al. took in consideration that motor behavior can be described at different levels: (1) velocity and body parts acceleration; (2) perceptual and cognitive processes [1]. DCD tends to be a chronic and permanent condition that interferes with activities of daily living and can result from difficulty in: 1: postural control; 2: slow and imprecise coordination and a variability in executed tasks; 3: difficulties in motor learning of new tasks, of tasks demanding anticipation and adaptation to changes, and difficulty in movement automation [9,10]. Some authors underlined that children with DCD tend to work slower, or to trade speed for accuracy [11]. They have to visually control their movement because of a probably abnormal proprioception [2,12].

Often, learning difficulties and *Attention Deficit Hyperactivity Disorder* (ADHD) are comorbid associations with DCD, being the consequences of delayed or lack of diagnoses [13,14]. They also get better achievements with their movements when they can concentrate on their activity [15]. Slowness enables these children to partly compensate for clumsiness, and when asked to quickly accomplish a task, they experience significantly greater levels of anxiety [16,17]. Their social life is also affected by DCD consequences; they have movement clumsiness [18], motor awkwardness and a tendency for loneliness and exclusion by peers [19]. This leads to social isolation, lack of motivation, low self-esteem, inactivity, depression, obesity and cardiovascular disease [10,13,20–22]. These DCD consequences, if not taken in charge, persist through adulthood and negatively impact on social and professional integration, as well as on their wellbeing [6].

1.2. DCD screening

The first operation of screening DCD is to identify the movement difficulties with the help of the parents and the educators by means of a written questionnaire such as the Developmental Coordination Disorder Questionnaire (DCDQ) [1]. Further investigations are conducted on the subjects with more appropriate procedures mainly the Bruininks Oseretsky Test of Motor Proficiency (BOTMP) and the Movement Assessment Battery for Children (M-ABC) [13,22–24]. Some occupational therapists use Rey Osterrieth Complex Figure to screen DCD [25]. Darsaklis et al. suggested to use Vineland Adaptive Behavior Scale-2 (VABS-2) in conjunction with M-ABC-2 and/or Bruininks–Oseretsky Test of Motor Proficiency-1st or 2nd edition (BOT-2) to provide information on daily activities of children to diagnose DCD [23]. We also refer to the excellent book first published in 1970 [26,27] then as a 3rd edition in 2010 [28]. This book, which was dedicated to the detection of "minor neurological dysfunction", was intended to be used by clinicians requiring minimal equipment and, at the same time, providing sequences of DCD assessments with scores. Although the scores are based on examination and are set for most characteristics to 0 (normal), 1 (mild) and 2 (really present), the scoring tends to portray some deficiency grading and statistical interpretations. Our present work was conducted for clinical assessments in similar fashion as described in this book.

It is expected that imaging of DCD might identify the brain structures involved in DCD. However, until now very few research works based on imaging have been reported, and those published pointed out different brain structures [29–36].

1.3. Subtyping

Subjects affected by DCD show a variety of symptoms generally affecting movement and perception, and consequently, their prognosis is different. Accordingly, the diagnostic criteria are not standard. It has been reported to classify children with DCD based on clinical or statistical (generally with cluster analysis) assessments [37–41]. In fact, Hoare measured visual perception, visuomotor integration, manual dexterity, kinesthetic acuity, balance, and running speed, and found five subtypes [38]. Dewey et al. studied balance, bilateral coordination, upper limb coordination, transitive gestures, and motor sequencing and found four subtypes [37]. Miyahara evaluated running speed, agility, balance, strength, upper limb speed, and dexterity, and found four subtypes [39]. Vaivre-Douret et al. classified children with DCD in three clinical subtypes: ideomotor, visual spatial/constructional and mix [40]. Thus, depending on the DCD characteristics analyzed and on the methods of analyses, the resulting subtypes remain different regardless of any comorbidity.

According to reported DCD publications, boys are more affected than girls [14,22]. The ratio varies from 2 boys for 1 girl to 5 boys for 1 girl [42,43]. There is also a tendency to a family history of DCD [44]. In order to classify children with DCD in a subtype depending on their similarities and differences, it is important to take into account several elements including comorbid conditions [44]. It has been reported that there are more left-handers in DCD population than in the general population [40,45–47], while there are around 10% of left-handers in the general population [46]. This suggests a role for cerebral lateralization in DCD pathophysiology