160 - MOTOR COORDINATION DISORDER IN MAINSTREAM PRIMARY SCHOOL CHILDREN

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Introduction

For a child to interact effectively with her/his environment involves a wide range of motor tasks. These vary from simple movement tasks performed in relatively stable situations, such as building blocks, posting coins, drawing and writing to rather complex actions performed under unpredictable contexts, such as ball games. Lack of movement competence affects the degree to which a child can function independently and effectively within her/his environment.

It is worldwide accepted that around 5% of the mainstream primary school children is affected by Developmental Coordination Disorder (DCD). Although some etiology and diagnosis issues on DCD are not clear (VISSER, 2003), DCD has been considered a childhood condition that has a significant impact on the child's process of acquiring motor skills, and participation pattern in typical physical activities of childhood. Children diagnosed with Developmental Coordination Disorder do have difficulty performing coordinated actions and this condition was officially recognised as a specific, primary disorder of motor development by the American Psychiatry Association in 1987. The term Developmental Co-ordination Disorder (DCD) was adopted to describe what was considered a marked impairment in the development of motor co-ordination that is neither explicable by mental retardation nor by any known physical condition. The World Health Organisation also described such a condition in the tenth edition of the International Classification of Disease in 1992 under the label of Specific Disorder of Motor Function (SDMF).

However, DCD has appeared in the research literature under different terms since the forties (BARNET, 1992). Dyspraxia, dysgnosia, poorly co-ordinated children, minimal brain damage, perception-motor dysfunction, sensory integration deficit, clumsiness, physical awkwardness etc are some terminology examples which have testified the multifaceted character of the disorder, the diverse background of the professionals (physical education teacher, physiotherapists, occupational therapists, paediatricians etc) involved with it and the theoretical presupposition on aetiology raised by researchers who have been studying DCD. Although still exists considerable discussion on terminology and the translated version of the DSM-IV (APA, DSM IV, 1995) to the Brazilian Portuguese language refers to this childhood disorder as TDC (*Transtorno da Coordenação Motora*), in this paper we will use the term DCD to refer to this condition following the suggestion made during the International Consensus Conference, in Canada, in 1994, when leading researchers in this field agreed to use the term "Developmental Coordination Disorder". One of the arguments by specialists on DCD around the world for using this term was that diversity in terminology interferes in the comparison of different studies.

Even though there has been an extensive professional discussion on children delayed motor skill development and the degree its effect on child´s ability to engage in age-appropriate daily activities, up to now there is no referral in the Brazilian national literature to the DCD, its characteristics, identification tools and diagnostic criteria, as well as intervention. In this paper we intend to draw the reader's attention mainly to the characteristics of the disorder its impact on the child's development and identification issues. This is because it is believed that professionals from physical education, sports sciences and related areas must be aware of findings on this subject as they can make significant contributions to the discussion on DCD.

The impact of DCD and co-occurrence with other childhood disorders

Despite their difficulties with motor activities, some children cope well with academic tasks and present some confidence in social contexts. If a child progresses academically, this may give a misleading impression of problems they may face, leading to a lack of concern about a motor disorder at primary age and reinforcing the alternative view that DCD children may grow out of it. There is evidence, however, that the effects of movement disorders on children do extend to other domains. For instance, children with DCD have been found to have long-term social (SCHOEMAKER & KELVERBOER, 1994), emotional, behavioral and academic problems (PIEK, & EDWARDS, 1997), and to be less physically active and to show significantly different patterns of social and physical play than their well-coordinated peers (POULSEN & ZIVIANI, 2004). DCD may be a risk factor for obesity in childhood and early adolescence (CAIRNEY ET ALL, 2005). Also it may have an effect on social and affective functioning, affecting negatively the areas of goal setting, self-concept, locus of control and self-esteem (HENDERSON, MAY, & UMMEY, 1989).

It is very common to find reports on co-occurrence between DCD and Attention Deficit Disorder and Hyperactivity (KAPLAN ET ALL, 1998; KADESJö & GILLBERG, 2001; ARTIGAS-PALLARES, 2003; MISSIUNA, GAINES & SOUCIE, 2006), Oppositional Defiant Disorder (KADESJO & GILBERT, 2001), specific language problems (RINTALA ET ALL, 1998), reading disorder (FLETCHER-FLINN, ELMES, & STRUGNELL, 1997), as well as learning difficulties (JONGMANS ET ALL, 1997).

Kaplan and colleagues (1998) have raised the question of whether groups of specific childhood disorders are separable, discrete syndromes or they are just one common deficit of a more general condition. Thus, they examined the comorbidity of Attention Deficit Hyperactive Disorder (ADHD), Developmental Co-ordination Disorder (DCD) and Reading Disorder (RD) in a sample referred to as having learning disorder. A group of children was classified as comorbid cases with at least two problems, a second group, consisted of children who could be included in either of the categories of disorders, and a third group was free of either conditions. After considering the limitations of the assessment tools and the validity of the taxonomic systems as contribuing factors to the failure to identify psychological disorders in childhood, Kaplan and colleagues proposed that comorbidity could be based on the prevalent underlying neurological conditions that lead to general learning disabilities in children. However, to date, no empirical neurological data have been found corroborating with Kaplan´s proposition.

It also remains not firmly established whether DCD generally occurs in isolation or if it corresponds to a pattern of impairments that is a manifestation of a more general underlying deficit. Although DCD has been delineated by specific symptomatology, and it seems to exist as a particular category of developmental disorders, it is possible that the presence of motor impairment is a shared characteristic between specific deficits that cannot be detected due to limitations in the assessment framework. The fact that the co-existence of DCD with learning disabilities is frequently reported, it has created the question on its specificity and indicates that this issue requires further systematic investigation.

It has also been suggested that DCD increases the risk of other learning difficulties at school age (LYYTINEN & AHONEN, 1989). Results from longitudinal studies have found a correlation between impaired ability in the motor domain and low educational achievement. Johnstone & Garcia (1994) suggested that motor problems like developmental co-ordination disorders

might interfere with a child's ability to fully exploit her/his cognitive abilities. Motor difficulties by themselves, however, warrant attention independent of the extent to which they affect other domains (WRIGHT & SUGDEN, 1996a). Being competent dealing with every-day living activities may grant confidence and self-esteem to children as they develop, encouraging to further interaction with their environment, building a secure base into childhood. Early identification is therefore important, while both classroom and physical education teachers contribute significantly with the identification process.

The characteristic of DCD

In childhood disorders a disparate pattern of deficits is not only present across domains of behaviour. The difficulties that children with movement problems experience also vary within the motor domain. Thus, DCD clinical manifestation has shown to be extremely variable. A range of distinct perceptual-motor difficulties, experienced by different children, has led to the view that DCD does not constitute a homogenous disorder. It is not difficult to find children with problems only in one specific functional skill (e.g. balance) and children with poor motor functioning across a range of skills. Some similarities have been found across studies, supporting a hypothesis that the heterogeneity within DCD may cluster into patterns. There are only few studies, however, which have addressed this issue. They took advantage of clustering procedures so that they outline specific group difficulties in DCD children that cannot be detected by inter-group comparison studies (WRIGHT & SUGDEN, 1996a). Clustering is also particularly useful for guiding intervention, as well as for comparing the efficacy of therapeutic procedures across specific sub-groups (HOARE, 1994).

Hoare (1994) carried out cluster analysis to investigate a sample of 80 children with DCD and five clusters were formed. The largest cluster comprised of children with poor running and kinaesthetic acuity, but good static balance and good fine manual control. The second largest group was constituted by children with poor kinaesthetic acuity and static balance with good visual skills. The third group had poor visual and kinaesthetic performance and below average scores in all the other measures. The fourth cluster comprised of children with problems in tasks involving a motor component but with good results in visual and kinaesthetic measures. The last cluster included children with good kinaesthetic acuity but poorer scores in visual performance. In a similar study, Wright & Sugden (1996a) found subtypes somewhat comparable to those found in Hoare's study. Four clusters formed in their study. The largest cluster comprised of the least impaired children whose scores were average in all assessed variables. The second cluster consisted of children who had problems coping with the environmental changes (throwing, aiming and catching) but had good control of their body movements when the environment was static. A third cluster showed the poorest performance in the majority of the areas and their best performance was in dynamic balance. The last cluster was formed by children with very poor manual dexterity and dynamic balance.

Some aspects of cluster analysis, however, must be taken into consideration when interpreting the characterisitcs of identified sub-types of DCD. For example, the constitution of the clusters depends on the variables included in the analysis as representative of the difficulties that the individual experiences. For example, Dewey and Kaplan (1994) also used cluster analysis to investigate sub-types within DCD. In Dewey's study subgroups of children were differentiated by specific deficit in motor sequencing and gestural performance. These variables were not present in the other two studies, although they are supposed to be a common trait among children with motor problems. The nature of the instrument of assessment, the presupposed deficits, and the sampling procedures (e.g. children referred to treatment versus children from the general population) are three other important aspects to be considered in the interpretation of sub-types within DCD.

Instruments of Assessment

Movement disorders in children such as DCD can be assessed via both qualitative and quantitative methods in complementary way. The observation of a child's general motor development by a parent or a teacher can be carried out in naturalistic settings. For example, Physical Education or classroom teachers may judge that a specific level of a skill is not appropriate for a child at that age level. However, the fact that qualitative measures depend on subjective judgement may affect the description of a child's motor ability, and can contribute to poor agreement between professionals. Quantitative assessments are helpful in these cases as they are guided by standardised procedures and are less likely to be biased by subjective judgement. But, they may be more difficult to apply. Some everyday functional skills are difficult to measure quantitatively and the quality of the function may be the most appropriate alternative for the assessment. When using judgement-based instruments, the scores given by teachers have correlated well with qualitative assessment conducted by a paediatrician or a psychologist (HENDERSON & HALL, 1982; JONGMANS ET ALL, 1993) and physical education teachers were found to be very efficient using standard observation procedures (PIEK AND EDWARDS, 1997).

Up to now, no assessment tool has gained a level of acceptance comparable to "gold standard" tests in other psychological domains (e.g. WISC). However, the Movement Assessment Battery for Children (MABC: HENDERSON & SUGDEN, 1992) has proven its usefulness and has gained extensive recognition among researchers and practitioners in Western Europe and non-European countries. The advantages of MABC are that it can be applicable by a wide range of professionals (physical education and classroom teachers, occupational and physical therapists, paediatricians, psychologists etc), includes a range of tasks familiar to the children and is quick to administer. The MABC consists of two instruments: the MABC performance test and the MABC checklist. The checklist assesses the performance of a child at a functional level and in realistic contexts. The MABC test is an ability-oriented, norm-referenced instrument that assesses Manual Dexterity, Ball Skills and Balance through eight functional tasks.

Recent studies have investigated the applicability and suitability of the published norms from MABC for Swedish (RöSBLAD & GARD, 1998), Dutch (SMITH-ENGELMANS, HENDERSON, AND MICHELS, 1998) and Japanese populations (MIYAHARA ET ALL, 1998). The MABC norms were found to be generally satisfactory for Dutch and Swedish children with only a few adjustments required. Some differences were found for the Japanese when compared to standardisation populations. However, the authors claimed that a larger, more methodologically appropriate study should be carried out before explaining any differences found. There is a study being currently carried out in the North of Brazil by our group. The preliminary results indicate that the MABC test is a suitable tool for 7 to 8 years old children, although some adjustment on the norms must be made for this age band.

The main issue within the identification debate is related to the need for early intervention. It has been demonstrated that without intervention the difficulties seen in early years can still be found in teenage years (LOSSE ET ALL, 1991). It has also been suggested that teenagers with DCD showed a lower motivational level towards physically based challenges (ROSE AND LARKIN, 1998) and more negative attitude towards physical activities (MEEK AND SUGDEN, 1997). It is possible that, because children with poorer motor skills fail more frequently in physically based challenges than their well co-ordinated peers, they are more likely to develop negative feelings about themselves as they grow and avoid situations that involve motor actions.

Conclusion

Motor coordination problems in otherwise healthy children of normal intelligence are common. These children are often noted by parents, caregivers and teachers to have problems with daily tasks such as dressing themselves, to trip when they run, to spill things frequently, to produce messy handwriting and drawing and to bump into things. They may be labeled as "clumsy," "awkward" and "lazy." These problems have been delineated by specific symptomatology, and it seems to exist as a particular category of developmental disorders.

Developmental Coordination Disorder (DCD) has been considered the usual and appropriate the term used when delayed motor skill development affects children ability to perform age-appropriate daily activities. The diagnosis, however, must consider a number of assessment criteria and must be only given by a competent professional (psychologist, paedaitricians etc). However, those who take part of a child's every day life are able to identify signs of DCD. In fact, what we advocate is that physical education and classroom teacher have an important role in this process.

Limitations in the assessment framework may lead to failure in the identification process, not only because presence of motor impairment may be a shared characteristic between specific deficits but also because there is much variation within the DCD group. Validation of good, accessible tools is urgently required. Lack of identification undermines early, appropriate intervention. Research has shown that children with these motor coordination problems often end up with serious academic and social impairments and problems with self-esteem. The notion that the disorder is temporary is equivocal. This strengthens the case for early detection and intervention.

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MOTOR COORDINATION DISORDER IN MAINSTREAM PRIMARY SCHOOL CHILDREN

Effective interaction of a child with her/his environment involves a wide range of motor tasks. These vary from relatively simple movement tasks performed in relatively stable situations, such as building blocks and drawing to rather complex actions performed under unpredictable contexts, such as ball games. Lack of movement competence affects the degree to which a child can function independently and effectively within her/his environment. The term Developmental Co-ordination Disorder (DCD) was adopted by the American Psychiatric Association to describe the condition in which a marked impairment in the motor co-ordination of primary school children's is neither explicable by mental retardation nor by any known physical disorder. DCD has been found to have long-term social, emotional, and academic impact, to affect children's attitude towards physical activities and to be a risk factor for obesity in childhood and early adolescence. In this paper we intend to draw the reader's attention mainly to the characteristics of the DCD, its impact on the child's development and identification issues. This is because it is believed that professionals from physical education, sports sciences and related areas must be aware of findings on this subject as they can make significant contribution for the discussion about scientific knowledge on DCD.

TRASTORNO EN LA COORDINACIÓN MOTORA DE NIÑOS DE LA ESCUELA ELEMENTAL

La interacción eficiente de un niño con su ambiente demanda una grande variedad de tareas motoras. Estas tareas pueden variar entre movimientos relativamente simple desempeñados en contexto estable, como por ejemplo, apilar bloques y diseñar, hasta tareas más complejas desempeñadas en contextos imprevisibles, como por ejemplo, juegos con bola. Ausencia de competencia motora afecta el grado con lo cual un niño puede funcionar independientemente en su ambiente. El termo *Developmental Coordinational Disorder* (DCD) fue adoptado por la Asociación Americana de Psiquiatría para describir esta condición en la cual un impedimento indudable en la coordinación motora de niños no puede ser explicado ni por retardo mental ni por alguna deficiencia física. Tiene sido considerado que DCD traje impacto social, emocional e académico de largo plazo, afecta la actitud de niños con relación a actividad física y es un factor de risco para obesidad infantil. En este trabajo a intención es llamar la atención del lector principalmente para las características de DCD, su impacto en el desarrollo infantil, y para la discusión sobre la identificación. Esto porque se acredita que profesionales de educación física, de la ciencia de los deportes y de otras áreas deben estar atentos para los encontrados de pesquisa en este campo, una vez que estés profesionales pueden dar contribuciones significantes para lo conocimiento científico sobre o DCD.

DÉSORDRE DE LA COORDINATION MOTRICE CHEZ LES ENFANTS DANS LES ÉCOLES PRIMAIRES

L 'interaction efficace d'un enfant avec son environnement implique une grande variété de tâches motrices. Ces tâches peuvent varier allant de mouvements relativement simples, exécutés dans un contexte stable, comme par exemple, empiler des blocs et dessiner, à des tâches plus complexes exécutées dans des contextes imprévisible, comme par exemple, jouer avec um ballon. L'absence de compétence motrice affecte le degré d'aptitude qu'un enfant a pour fonctionner indépendamment dans son environnement. Le terme Developmental Coordination Disorder (DCD) a été adopté par l'association Américaine de Psychiatrie pour

décrire cette condition dans laquelle un empêchement marquant de la coordination motrice chez des enfants ne peut être expliquée ni par le retard mental, ni par une déficience physique. Il a été considéré que le DCD a des impacts sociaux, émotionnels, sur les résultats scolaires a long terme, affecte l'attitude des enfants face à l'activité physique et est un facteur de risque pour l'obésité infantile. Ce travail a pour but d'attirer l'attention du lecteur principalement sur les les caractéristiques du DCD, son impacte sur le développement infantile et sur la discussion de son identification. C'est pourquoi nous croyons que les professionnels du domaine de l'éducation physique, des sciences des sports et d'autres secteurs adjacents, doivent prêter attention aux découvertes résultant de recherches sur ce sujet sachant que ces professionnels peuvent contribuer grandement au savoir scientifique du DCD.

TRANSTORNO DA COORDENAÇÃO MOTORA EM CRIANÇAS DA ESCOLA PRIMÁRIA

A interação eficiente de uma criança com seu ambiente envolve uma grande variedade de tarefas motoras. Estas tarefas podem variar entre movimentos relativamente simples desempenhados em contexto estável, como por exemplo, empilhar blocos e desenhar, até tarefas mais complexas desempenhadas em contextos imprevisíveis , como por exemplo, jogos com bola. Ausência de competência motora afeta o grau com o qual uma criança pode funcionar independentemente em seu ambiente. O termo *Developmental Co-ordination Disorder* (DCD) foi adotado pela Associação Americana de Psiquiatria para descrever esta condição na qual um impedimento marcante na coordenação motora de crianças não pode ser explicado nem por retardo mental nem por alguma deficiência física. Tem sido considerado que DCD traz impacto social, emocional e acadêmico de longo prazo, afeta a atitude de crianças em relação à atividade física e é um fator de risco para obesidade infantil. Neste trabalho a intenção é chamar a atenção do leitor principalmente para as características da DCD, seu impacto no desenvolvimento infantil, e para a discussão sobre a identificação. Isto porque se acredita que profissionais de educação física, das ciência dos esportes e de áreas correlatas devem estar atentos para os achados de pesquisa neste campo, uma vez que estes profissionais podem dar contribuições significantes para o conhecimento cientifico sobre o DCD.