

Motor Performance and Activities of Daily Living in Children with Developmental Coordination Disorder

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Abstract

Purpose: The aim of this study was to evaluate the motor performance, activities of daily living and their relationship in children with developmental coordination disorder.

Subjects and Methods: Thirty seven cases with developmental coordination disorder and thirty five typically developing peers between the ages 9-10 were included as a control group in this study. The Bruininks-Oseretsky Test of Motor Proficiency Short Form (BOTMP-SF) was used to evaluate the motor performance, and the Functional Independence Measure for Children (WeeFIM) was used to evaluate the activities of daily living.

Results: Significant differences were found in activities of self care, bathing, and toileting in favor of control group ($p < 0.05$), and no differences were found in activities of eating, and dressing upper and lower body parts. Comprehension, and expression skills were significant in favor of the control group ($p < 0.05$). No correlation was found between Bruininks-Oseretsky Test of Motor Proficiency total score and subgroups of WeeFIM for either group ($p > 0.05$).

Discussion: Motor performance and activities of daily living can affect children with developmental coordination disorder but their correlation is controversial. Both domains should be taken into account when implementing effective interventions to promote independence.

Keywords: Developmental coordination disorder; Motor performance; Activities of daily living

Introduction

Developmental coordination disorder has been described as “impairment or immaturity of the organisation of the movement” by the Dyspraxia Foundation [1]. As the definition describes, developmental coordination disorder (DCD) significantly affects the child’s daily activities such as educational success, dressing, shoe tying, teeth brushing, and ability to participate in sport activities [2]. Although it is not mentioned in any classification system, most commonly used synonyms are “clumsy child syndrome”, “the original developmental disorder of the motor functions” as defined in ICD-10, and the “Developmental Coordination Disorder” as defined in DSM-IV. This term is accepted by American Psychiatric Association (APA) in 1994 [3].

DCD is a chronic condition involving impairment in gross motor, postural and/or fine motor performance that affects child’s ability to perform the skilled movements necessary for daily living, including the performance of academic and self-care tasks. The studies that are conducted to identify these children have shown that their motor performances are slower, less accurate and more variable and have some deficiencies in some domains of activities of daily living according to their typical peers [4-8]. These children struggle with daily functional tasks such as dressing, throwing and catching balls and learning to ride a bicycle [9,10].

DCD and activities of daily living

Motor disorders are seen in almost every area of children with DCD [11]. These children are slower than their typical peers, and display deficiencies in both gross and fine motor skills [12-15]. In some studies of children with DCD, no significant correlations were found between motor performance and personal care. On the contrary, in some studies it was shown that children with DCD experience

difficulties in daily living skills such as dressing, eating, and personal hygiene [15-18]. Other domains in the activities of daily living such as mobility, bathing, toileting, comprehension and expression skills and their relation to the motor performance were not assessed. These parameters have to be investigated for prognosis and management of children with DCD.

There are some studies in the literature which convey that children with DCD have motor deficiency. But there is a lack of evidence in relation to the activities of daily living particularly in some domains. The aim of this study was to evaluate the motor performance, activities of daily living and their relationship in children with DCD.

Method and Subjects

A group of 72 children (34 girls, 38 boys) between the ages 9-10, which included 37 children with DCD and 35 typically developing peers who served as age-matched controls, were recruited in the study.

The criteria for participation in the study included; age between 9-10 at the time of intake; previous identification by a qualified physician as having the diagnosis of DCD; normal intelligence; normal hearing and vision. Children who met the following criteria

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were excluded from participation in the study; previous or present exposure to a cognitive-based treatment for motor problems; and medical diagnosis of a specific neurological disorder or a physical or sensory deficit causing the motor problem.

All subjects read and gave written informed consent on a university approved consent form from the Ethics Committee of the Hacettepe University (LUT 09/48). Patients and parents were informed about the evaluation procedure and the outcomes. Motor performance evaluations were done by a single physiotherapist qualified in pediatrics who had 12 years of experience and was blinded to group membership in an isolated room one by one. The Wee-FIM was completed through parent interview.

The Bruininks-Oseretsky Test of Motor Proficiency-Short Form (BOTMP-SF) [20] is a commonly used test to determine the motor proficiencies of children between 4.5 and 14.5 years of age who take part in pediatric rehabilitation. It consists a total of forty six tests in eight subtests. Four of these subtests evaluate gross motor skills (running speed and agility, balance, bilateral coordination, strength), one subtest evaluates both the gross motor and the fine motor skills (upper extremity coordination), and the remaining three subtests evaluate fine motor skills (response speed, visual-motor control, upper extremity speed and skill). The test is completed approximately in 45 to 60 minutes with an ICC of 0.9 [20,21].

Functional Independence Measure for Children [22,23] evaluates the fields of self care, mobility and cognition with the sub-parameters. Functional Independence Measure for Children (WeeFIM) was derived from the Functional Independence Measure (FIM) that developed for adults by Uniform Data System for Medical Rehabilitation (UDS) [40]. WeeFIM measures the functional independence in children. Two approaches that are related to functional independence constitutes the basis for WeeFIM [41]. WeeFIM can be used in children between 6 months and 12 years and with developmental disorders, in children of any age with a mental age below 7, and in children between 6 months and 8 years without any disorders (ICC: 0.9) [24,25].

Statistical analysis

SPSS for Windows software package was used for the statistical analysis of this study. Results of BOTMP-SF and WeeFIM were analyzed using t test. Correlation between BOTMP-SF and WeeFIM was evaluated using Pearson correlation analysis. P-values less than 0.05 were considered statistically significant [26].

Results

Mean age of the 21 boys and 16 girls in the study group, and 17 boys and 18 girls in the control group were 10 ± 1.5 years and 10 ± 2 years, 10 ± 0.8 years and 9 ± 1 years, respectively. There was no statistically significant difference between the ages of the groups ($p > 0.05$).

Results of the gross motor skills tests, both the gross motor and the fine motor skills tests, and only fine motor skills tests, all of which evaluate motor proficiency, are shown in Table 1.

In the subtest of BOTMP-SF, running speed and agility, walking forward heel-to-toe on balance beam, tapping feet alternately while making circles, jumping up and clapping hands, standing long jump, response speed, draw a line through a straight path, copying a circle, sorting cards, and making dots were found to be significant in favor of typical peers ($p < 0.05$).

Results of personal care domain of the WeeFIM test which is used to evaluate activities of daily living are shown in Table 2. Results of mobility and cognition tests are shown at Table 3.

Significant differences were found in grooming, bathing, and toileting ($p < 0.05$) in favor of healthy peers and there was no difference in the activities of eating, and dressing upper and lower body. Comprehension and expression skills were significant in favor of the control group ($p < 0.05$).

There was no correlation between BOTMP-SF total score and the sectional and total scores of WeeFIM in both groups ($p > 0.05$).

	Running speed and agility X \pm SD	Standing on preferred leg on balance beam X \pm SD	Walking forward heel-to-toe on balance beam X \pm SD	Tap-ping feet alternate-ly while making circles X \pm SD	Jumping up and clapping hands X \pm SD	Standing broad jump X \pm SD	Catching a tossed ball with both hands X \pm SD	Throwing a ball to a target X \pm SD	Response speed X \pm SD	Drawn a line through a straight path X \pm SD	Copying a circle X \pm SD	Copying overlapping pencils X \pm SD	Sorting cards X \pm SD	Making dots X \pm SD
Group 1	0.97 \pm 2.25	2.38 \pm 1.48	1.11 \pm 1.1	0.16 \pm 0.37	0.54 \pm 0.6	3.41 \pm 1.12	2.54 \pm 0.93	1.81 \pm 0.74	5.57 \pm 2.51	3.22 \pm 1.08	1.81 \pm 0.39	0.89 \pm 0.97	3.46 \pm 1.32	3.38 \pm 1.48
Group 2	7.74 \pm 1.93	2.09 \pm 0.74	1.97 \pm 0.89	0.63 \pm 0.49	1.26 \pm 0.78	5 \pm 1.28	2.63 \pm 0.69	1.77 \pm 0.43	9.34 \pm 3.19	3.94 \pm 0.24	2 \pm 0.00	1.09 \pm 0.82	4.31 \pm 0.87	5.09 \pm 1.5
p	0.000	0.296	0.001	0.000	0.000	0.000	0.651	0.784	0.000	0.000	0.006	0.363	0.002	0.048
t	-13.651	1.052	-3.647	-4.555	-4.369	-5.632	-0.454	0.275	-5.587	-3.88	-2.818	-0.916	-3.22	-2.013

Group 1: Children with DCD, Group 2: Typically developing children, X: mean value, SD: Standard deviation, ($p < 0.05$)

Table 1: The Bruininks-Oseretsky Motor Proficiency Test results.

	Eating X \pm SD	Grooming X \pm SD	Bathing X \pm SD	Dressing upper body X \pm SD	Dressing lower body X \pm SD	Toileting X \pm SD	Bladder management X \pm SD	Bowel management X \pm SD
Group 1	7 \pm 0	5.97 \pm 0.928	5.84 \pm 0.898	6.81 \pm 0.569	6.84 \pm 0.553	6.7 \pm 0.702	7 \pm 0	7 \pm 0
Group 2	7 \pm 0	7 \pm 0	7 \pm 0	7 \pm 0	7 \pm 0	7 \pm 0	7 \pm 0	7 \pm 0
p	1.000	0.000	0.000	0.053	0.088	0.015	1.000	1.000
t	1.000	-6.548	-7.654	-1.965	-1.733	-2.505	1.000	1.000

Group 1: Children with DCD, Group 2: Typically developing children, X: mean value, SD: Standard deviation, ($p < 0.05$)

Table 2: WeeFIM self-care test results.

	Wheelchair, chair transfer X±SD	Toilet transfer X±SD	Bath/shower transfer X±SD	Crawling , walking, wheelchair X±SD	Stair climbing X±SD	Comprehen- sion X±SD	Expression X±SD	Social interac- tion X±SD	Problem solving X±SD	Memory X±SD
Group 1	7±0	7±0	7±0	7±0	7±0	5.72±1.233	5.19±1.221	5.78±1.228	4.76±0.955	4.62±0.982
Group 2	7±0	7±0	7±0	7±0	7±0	6.54±0.505	6.8±0.473	6.71±0.519	6.57±0.558	6.66±0.539
p	1.000	1.000	1.000	1.000	1.000	0.001	0.000	0.000	0.000	0.000

Group 1: Children with DCD, Group 2: Typically developing children, X: mean value, SD: Standard deviation, (p<0.05)

Table 3: WeeFIM mobility and perception test results.

Discussion

The results of our study shows that children with DCD are inadequate in executing motor performance and less independent in the activities of daily living compared with typically developing peers. There was no correlation between the motor performance and activities of daily living in both groups.

In a study for determining the validity and reliability of the BOTMP-SF in 5-year-old children it was concluded that the test doesn't evaluate the fine motor and gross motor skills separately, but evaluates the overall motor efficiency [27]. Dewey and colleagues [28] evaluated the motor performances of 49 children with autism and mean age of 10.2, and children of the same age group with DCD, attention deficit and hyperactivity disorder, and normal development with BOTMP. The total scores obtained from the study are 38.6 in autistic children, 43.6 in children with DCD, 59.8 in children with attention deficit and hyperactivity disorder, and 62.1 in children with normal development. The score of 43.6 in children with DCD indicated that their motor deficiencies are much more than the the group of children with attention deficit and hyperactivity disorder and children with normal development. Additionally, the total score of 42 points or less from BOTMP is stated as a measure of motor impairment [20] as seen in our study.

Children with DCD had deficiencies in their gross motor performance compared to their healthy peers [12,13]. This result is similar to our findings in gross motor skill tests. It is obvious that all these parameters require enough coordination, which is less in children with DCD, according to their typical peers.

Absence of difference between the groups in balance was thought that children with DCD demonstrate inappropriate and ineffective neuromuscular strategies, both in muscular activation and in sequencing [29]. Similarly, there was no significant difference between the tests evaluating the coordination of the upper extremities which is a part of playing activities in daily life. Considering the age ranges in both groups, it was thought that playing is the basic common activity for all children regardless of their state.

WeeFIM assesses the activities of daily living in children, it rather shows the performance in the parameters related to self-care, mobility and cognition. Children spent more time on playing in everyday life. It can be seen that WeeFIM may have missing aspect of evaluation of daily living activities in children. For this reason, evaluation of motor performance in children, interpreted with the results of WeeFIM, may give more clear information about the activities of daily living.

Significant results were seen in favor of typical peers in self-care, bathing, and toileting activities of personal care domain that shows the personal development. On the other hand there was no difference in the activities of eating, and upper and lower body dressing. It is known that skills in the daily living activities are

acquired in early childhood. Because of that, the scores obtained from sphincter, bladder, and bowel control were full. All the cases in both groups were independent in their transfer and mobility activities. Comprehension and expression skills were significant in favor of the control group. Social communication, problem-solving skills, and the results obtained from the evaluation of memory were found to be statistically significant in favor of typical peers in the domain of social communication.

Summers and colleagues [11] assessed the activities of daily living of Australian and Canadian parents in children with DCD between ages 5 to 9. When compared with the typically developing peers, they experienced difficulties in dressing, personal care and eating skills. Although after 6-9 years of age they show similar skills to their typical peers, they still have delays in self-care domain. Similar results were found in our study in self care, but no differences were found in dressing and eating skills. They reported that deficiencies of postural control and fine motor skills may cause this type of inadequacy in activities of daily living.

Children with DCD move more slower compared with their typical peers [30,31]. WeeFIM doesn't evaluate speed and endurance in an activity, and it is concluded in this study that tests which evaluate the speed and endurance shall be more effective in evaluation of children with DCD.

Children with DCD experience difficulties in activities such as dressing, personal hygiene, and eating as shown in some studies [16, 17,19,30] . These results are controversy to this study. Differences are thought to be caused by differences in age of the patients included in the study. Despite of this, Case-Smith [32] could not found a strong correlation between motor performance and self-care activities in his study. The cause of the difference between this study [32] and the others [14,17-19,32] was taught to be perception level of the parents, environment that the activities of daily living are performed, and cultural differences.

Similarly to the results of this study, no correlation was found between motor impairments and self-care in the study of Case-Smith [32]. Self-care represents more the personal development and is not entirely part of motor performance, so it was thought that it may not be correlated with motor impairment.

Sensory-motor coordination deficiency may lead to DCD [33]. In the same study poor visual and spatial organization was reported to affect adversely motor skills and social interactions in children with DCD. Similarly, children with DCD were found to be inadequate in social communication compared with the typical peers in this study.

Functional performance in activities of daily living of children with different motor coordination problems in school and at home were examined in a study [34]. They have evaluated 16 children with DCD, 25 children with suspected DCD and 63 typical peers

and reported that the children with diagnosed and suspected DCD have significantly lower performance than other children which was consistent with our results.

No correlation was found between BOTMP and WeeFIM in both groups. BOTMP evaluates the motor performance especially considering the movement speed, on the contrary WeeFIM does not make any measurement about the speed for assessing the execution of an activity. Additionally, when the parameters in WeeFIM are considered, it can be thought that, it covers more personal and social development domains rather than the gross motor performance. It is also kept in mind that BOTMP gives information about playing activities of children. When talking about child, playing constitutes a large part in activities of daily living.

Motor performance and activities of daily living can be affected in children with developmental coordination disorder but their correlation is controversial. As a conclusion, motor performance and activities of daily living should be considered together and other factors affecting these parameters should be taken into account for the assessment, management and rehabilitation in children with DCD.

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