

Comparison of motor praxis and performance in children with varying levels of developmental coordination disorder

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Introduction

- ⌋ **Dyspraxia, a difficulty in motor planning or programming, has been associated with developmental coordination disorder (DCD)**
- ⌋ **The term indicates that the problem lies with “praxis,” i.e. the impairment of the ability to plan and execute movements**
- ⌋ **A survey of health and educational professionals showed widespread uncertainty about the definitions of, and distinction between, DCD and dyspraxia (Peters, Barnett, & Henderson, 2001)**

Introduction

- u For the evaluation of dyspraxia, the most common method used to assess limb praxis is observing a child/adult producing or imitating a range of gestures
- u These gestures can be elicited under different modalities such as verbal command and imitation
- u Motor imagery has also been considered with reference to gesture production in children with developmental dyspraxia

Introduction

- u To date, for the identification of children suspected of having DCD, M-ABC (Henderson & Sugden, 1992), BOTMP (Bruininks, 1978) and TOMI (Stott, Moyes & Henderson, 1984) mostly used standardized motor assessments
- u In view of the lack of classification in neurological signs or physical impairment, it is important to understand the nature of motor praxis problems observed in children with DCD

The aim of this study

- u This study was designed to address issues from previous studies in a number of ways, with a key aim to compare the non-symbolic, intransitive and transitive gestural performance and praxis imagery between children with DCD and their typically developing age-matched controls.

Methods

Characteristics of the groups

	Groups			Statistics
	nDCD (n=37)	sDCD (n=13)	cDCD (n=11)	
Age (mo)	82.5 (6.7)	81.9 (5.0)	84.6 (7.4)	$F_{2,58}=.584, p=.561$
Gender (male/female)	22/15	7/6	7/4	$\chi^2=.244, p=.885$
Handedness (right/left)	32/5	10/3	9/2	$\chi^2=.673, p=.714$
M-ABC	79.9 (7.1)	64.8 (3.4)	43.8 (9.8)	$F_{2,58}=117.034, p<.001$
Manual dexterity	27.0 (5.6)	21.6 (5.0)	14.8 (5.6)	$F_{2,58}=21.535, p<.001$
Ball skills	20.0 (5.1)	15.8 (3.5)	12.5 (4.2)	$F_{2,58}=12.133, p<.001$
Balance	32.9 (4.2)	27.3 (4.3)	16.0 (4.6)	$F_{2,58}=65.822, p<.001$

Development of dyspraxia test

u Dyspraxia tests used in this study include

Assessment of gesture production,

Praxis imagery questionnaires, and

Knowledge of object use.

u All tests have been modified according to domestic culture and environment.

7

Methods

Praxis imagery questionnaire

u It consisted of 8 items in four subscales designed to assess different aspects of praxis imagery:

kinesthetics, body position, action, and object.

u Each correct answer was awarded 1 point, giving a maximum score of 8 per subscale and 32 in total.

Praxis imagery questionnaire

Given an example of a question about the use of chopsticks, children were asked to imagine that they were using the chopsticks to pick up a piece of food. They were then asked the following questions:

- ☐ “Which joint moves more?” to address the *kinaesthetic* aspect;
- ☐ “The palm is facing ceiling or table?” to address the *position* aspect;
- ☐ “When opening the chopsticks, is the index finger moving toward or away from the thumb?” to address the *action* aspect;
- ☐ “Which end of the chopsticks is thinner?” to address the *object* aspect.

Assessment of gesture production

There were three categories of motion to test gestural production (**8 transitive**, **8 intransitive**, and **8 nonsymbolic** motions)

Gesture production of transitive and intransitive motion (Examples)

Transitive	Intransitive
1. Show me how you brush your teeth with a toothbrush	1. Show me how you salute
2. Show me how you comb your hair with a comb	2. Show me how you blow a kiss
3. Show me how you eat soup with a spoon	3. Show me that you have a full stomach
4. Show me how you answer the phone	4. Show me how you blow your nose

11

Examples of non-symbolic motion items



The scoring criteria for assessment of gesture production

Goal	Error type	Joint coordination
2 Achieved	No	Normal
1 Achieved	Pattern remains Recognizable but errors occur in 1. Body-part-as-object 2. Orientation 3. Position 4. Location	Pattern remains recognizable but 1. Slow or sloppy 2. Extra movements (overshoot) and omissions 3. Timing incorrect 4. force inadequate 5. reduced amplitudes.
0 Not achieved	Unrecognizable movement	No temporal or spatial relationship to the requested gesture.

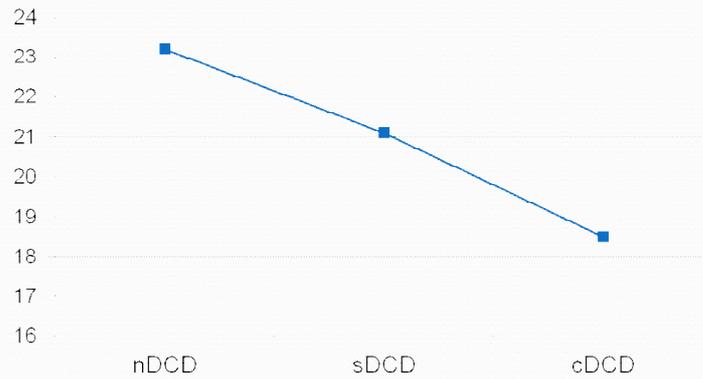
13

Statistical Analyses

- Repeated measures ANOVA were employed to compare the two types of gestural representation across the three groups.
- Significant ANOVA results were followed up using post hoc comparisons with Tukey HSD.
- Using the Pearson correlation analysis, the relationship between the subtests of developmental praxis and the results of the M-ABC test were analyzed.

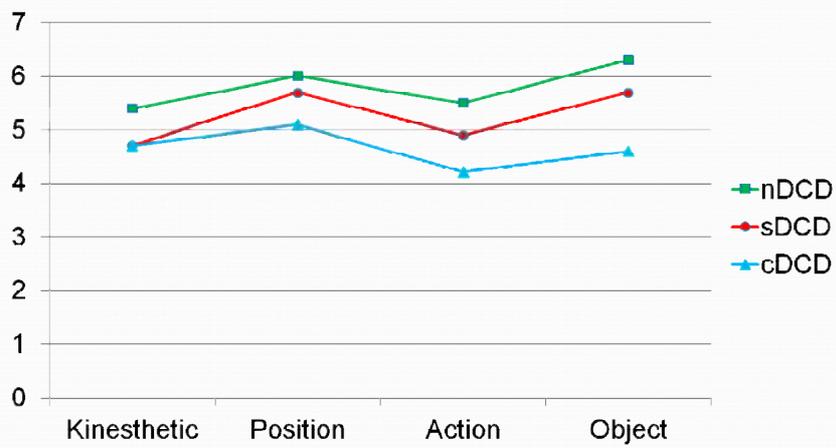
Results

Praxis imagery questionnaire



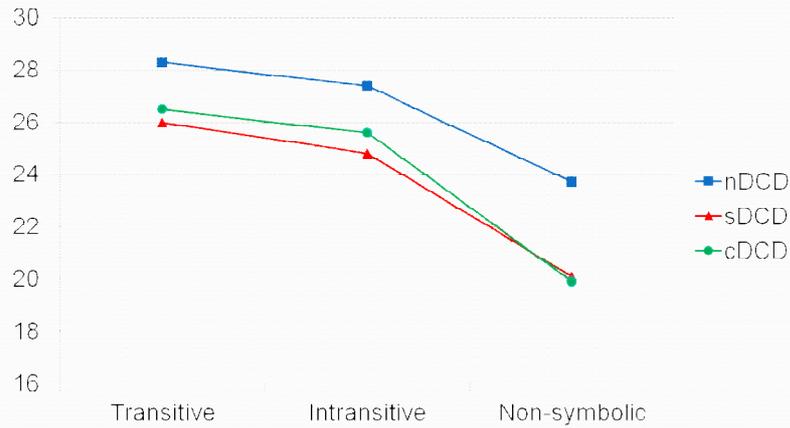
Results

Comparison of subscales across groups in *praxis imagery questionnaire*



Results

Gesture production tests



Correlation coefficients between scores of Imagery Praxis Test and M-ABC

	Subtest			M-ABC
	Manual dexterity	Ball skills	Balance	
Praxis imagery questionnaire	$r=.353^{**}$	$r=.298^*$	$r=.310^*$	$r=.410^{**}$
Transitive gesture	$r=.217$	$r=.315^*$	$r=.083$	$r=.251$
Intransitive gesture	$r=.141$	$r=.162$	$r=.152$	$r=.196$
Non-symbolic gesture	$r=.250$	$r=.146$	$r=.207$	$r=.267^*$
Knowledge of object use	$r=-.013$	$r=.108$	$r=.121$	$r=.091$

Discussion

- Children with either suspected or confirmed DCD showed significantly lower scores than children without problems in motor coordination in all tests except for *transitive gesture* and *knowledge of object use*.
- Similar to previous studies (Dewey, 1991; Sinani et al., 2012; Wilson et al., 2001; Zoia et al., 2002), the results of this study revealed a deficit in some components of motor praxis in children with DCD.
- However, it was not evident in all components of motor praxis.

Discussion

- This study found some children without DCD scored lower in praxis tests than the average and even lower than the average of the DCD group.
- They exhibited the feature of developmental dyspraxia; however, they were not verified as either suspected or confirmed DCD.
- As suggested by Dewey and Kaplan (1994), the clinical features of developmental dyspraxia were shown to be closer to motor planning and programming disorder than to executive disorder.

Conclusion

- u Our study provides a better understanding of the nature of the developmental dyspraxia and sheds light on its effect on motor coordination, so as to identify praxis tests with specific clinical meanings in children with movement disorder.
- u It is suggested that motor praxis tests be used as an adjunct of M-ABC to identify or characterize the disorder in children with suspected motor impairment.