A study of tool using during contact phase in children with ADHD: the praxis perspective

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Abstract
Although three major syndromes of ADHD are inattention, hyperactivity, impulsion, the studies pointed that approximately 50% ADHD had motor problems. The purpose of this study was to examine the difference of tool use performance during contact phase while grasping and using tools between the children with ADHD (10) and the controls (5).

The participants of the study were 5 pure ADHD, 5 ADHD combined DCD, and 5 typical control children. All children were right handed with age from 5-7 years. In the experiment, each child had to grasp and use 12 different tools. The handle of each tool was positioned toward four directions (right, left, forward and backward) respectively and all participants had to grasp the handle under the situation of each direction. Therefore, each child performed 48 grasps totally (12 tools x 4 directions). The method used to evaluate praxis was applied to analyze the error types of each grasp during the contact phase.

Results showed that children with ADHD had the better performance when the handle was put toward right side. Furthermore, they performed more occurrence and movement errors than the controls.

It is suggested that ADHD have better tool use performance in a familiar condition (the handle was put toward right side).

Objectives
Although three major syndromes of ADHD are inattention, hyperactivity, impulsion, the studies pointed that approximately 50% ADHD had motor problems. However studies in children with ADHD and ADHD combined DCD on motor pattern are scarce. So we want to know about action planning of the children with ADHD and ADHD combined DCD in goal-directed behavior.

The main purpose of the present study was to investigate the difference of tool use performance during contact phase while grasping and using tools between the children with ADHD, ADHD combined DCD, and control children.
**Design and Methods**

A total of 15 children (all males, mean age = 6 years 3 months) participated in this study. Three groups ranged in age from 5 to 7 years: (i) 5 were children with ADHD only (ADHD-only), (ii) 5 were children with ADHD combined DCD (ADHD+DCD), (iii) 5 were sex-, grade-, age-matched control children.

Each child was tested individually in a sound-attenuated room by the same examiner. The testing was completed in one session. All subjects performed the limb gestures with their right dominant hand. In the experiment, each child had to grasp and use 12 different tools. The handle of each tool was positioned toward four directions: right, left, forward and backward respectively (Figure I) and all participants had to grasp the handle and then used the tool under the situation of each handle direction. Therefore, each child performed 48 grasps totally (12 tools x 4 directions). The method used to evaluate praxis was applied to analyze the error types (Table I) of each grasp during contact phase.

Mann-Whitney U tests were performed to compare the number of errors between paired groups. Owing to the three multiple comparisons being made, probabilities were derived using Bonferroni adjustments, and this resulted in a significance level of .0167.

**Figure I— The conditions of handle directions**

![Figure I](image)

**Results**

In the condition of right handle direction, there was a significant difference in the total error number between the control group and the ADHD+DCD group ($p = .008$). The control group ($M = 17.8$, $SD = 3.271$) produced fewer errors than the ADHD+DCD group ($M = 28.8$, $SD = 6.301$). In the condition of left handle direction, there was a significant difference in the total error number between the control group and the ADHD group ($p = .008$). The control group ($M = 35$, $SD = 7.382$) produced fewer errors than the ADHD group ($M = 51.6$, $SD = 3.647$). In the condition of forward handle direction, there was a significant difference in the total error number between the control group and the ADHD+DCD group ($p = .008$). The control group ($M = 19.8$, $SD = 3.493$) produced fewer errors than ADHD+DCD group ($M = 32.6$, $SD = 10.237$). There was no significant difference between any two groups in the
backward handle direction.

Although the control group had better performance than the other two groups, all three groups produced similar error types in all conditions of handle conditions during the contact phase, including spatial errors (e.g. grasp position, internal orientation, hand shape, and movement) and content error (e.g. helper).

Compare each error type, there was no significant difference between any two groups in the right handle direction. In the left handle direction, ADHD group produced significantly more internal orientation than the control group ($p = .016$), and ADHD group also produced significantly more hand shape than the control group ($p = .008$). ADHD+DCD group produced significantly more hand shape than the control group ($p = .016$) in this direction too. In the forward handle direction, ADHD group produced significantly more helper than the control group ($p = .016$), and ADHD+DCD group produced significantly more internal orientation than the control group ($p = .008$).

In the backward handle direction, ADHD group produced significantly more occurrence than the control group ($p = .016$).

**Conclusions**

No matter the children with ADHD or ADHD combined DCD, they performed more spatial errors than the normal children in the left and forward handle directions. It might mean that in the unfamiliar conditions children with ADHD and ADHD combined DCD tend to use non-functional grasping movements during contact phase and they have more internal representation difficulties in the unfamiliar conditions.

However there were no significant differences in all comparison between the children with ADHD and ADHD combined DCD. It might suggest that the children with ADHD and ADHD combined DCD have the same mechanism of action planning which is not buried by motor problem.

**References**


