

The relationship between handwriting in children with ADHD and symptoms of hyperactivity and impulsivity

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Introduction

- Previous research using subjective ratings of handwriting quality have found that children with ADHD have messy or illegible handwriting (Adi-Japha et al., 2007; Tucha & Lange, 2001, 2004, 2005).
- Kinematic studies examining writing in children with ADHD off medication have found no kinematic differences to the writing of control children.
- Some have suggested that ADHD symptoms, particularly inattention, are strongly associated with motor difficulty (Tucha & Lange, 2004).
- Langmaid et al. (2012) determined that children with ADHD had more variable writing, and that inattentive and hyperactive symptoms may play a role in motor deficits.
- The purpose of the present study** was to use kinematic analysis to examine the relationship between ADHD symptoms and handwriting.

Methods

- Children with and without ADHD in Grades 4-8 were recruited for this study. Children with ADHD were tested off their medication.
- The Conners 3 Parent form was used to assess ADHD symptomatology.
- Handwriting quality was measured using the standard score of the Manuscript and Cursive versions of the Test of Handwriting Skills – Revised (THS-R).
- Overall ‘grand mean’ of normalized jerk (NJ), stylus pressure (SP), peak vertical velocity (PVV), and relative intraindividual standard deviation of peak vertical velocity (RPVV) scores were computed separately for the Manuscript and Cursive versions of the THS-R, both completed on the digitizing tablet.
- Spearman correlations were examined between overall standard scores of the THS-R Manuscript and Cursive versions and T-scores of the following Conners 3P scales: Inattentive (IN), DSM-IV-TR Inattentive (AN), Hyperactive (HY), and DSM-IV-TR Hyperactive/Impulsive (AH).

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Correlations between ADHD Symptoms and Manuscript Handwriting Performance

	IN	HY	AN	AH	Manu SS
Standard Score	-.13	-.24	-.26	-.32	
Mean Overall NJ	.15	.37*	.19	.34*	-.14
Mean Overall SP	.09	-.02	.17	.04	-.12
Mean Overall PVV	.11	.01	-.06	.08	-.30
Mean Overall RPVV	-.10	.17	-.03	.25	-.28

* $p < 0.05$, ** $p < 0.01$

Correlations between ADHD Symptoms and Cursive Handwriting Performance

	IN	HY	AN	AH	Cursive SS
Standard Score	.10	.10	-.03	-.15	
Mean Overall NJ	.03	.18	.06	.16	-.23
Mean Overall SP	-.03	-.19	.08	-.14	-.16
Mean Overall PVV	.21	.14	.15	.22	-.43**
Mean Overall RPVV	.10	.18	-.03	.18	-.45**

* $p < 0.05$, ** $p < 0.01$

Results

- 38 children with ADHD (30 males, 8 females) and 28 children without ADHD (15 males, 13 females) participated in this study.
- Children with ADHD had lower quality of manuscript writing ($M=99.71$, $SD=8.93$) as compared to control children ($M=108.96$, $SD=10.70$), $t(64) = -3.82$, $p = 0.00$.
- Children with ADHD also had lower quality cursive writing ($M=82.95$, $SD=10.94$) as compared to control children ($M=97.46$, $SD=14.50$), $t(64) = -4.64$, $p = 0.00$.
- No statistically significant correlations were found between any ADHD symptom severity scores and any of the THS-R Cursive kinematic variables.
- Fair correlations were found between the Conners 3P Hyperactive (0.37) and Conners 3P DSM-IV-TR Hyperactive/Impulsive (0.34) scale T-scores and the THS-R Manuscript mean overall NJ score.
- Moderate negative correlations were found between the THS-R Cursive overall standard score and PVV (-.43) and RPVV (-.45).

Discussion & Conclusions

- This is the first study to examine children’s cursive and manuscript writing abilities objectively.
- In contrast to previous studies, we found a relationship between hyperactivity/impulsivity symptoms (instead of inattention symptoms) and handwriting fluency, but only for manuscript writing, suggesting that unmedicated children with ADHD have difficulty regulating more automatic written output.
- This relationship was not found for cursive writing, suggesting this more novel task is not influenced by symptoms of inattention or hyperactivity/impulsivity.
- Cursive writing is no longer emphasized in elementary school, therefore may have been perceived as a novel task by children.
- Children with ADHD may have difficulties adjusting to novel tasks and have difficulties generalizing motor programs to novel situations.