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Research Brief

Sensory Motor Differences in Attention Deficit Hyperactivity Disorder and Traumatic Brain Injury

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Introduction

Individuals who have been diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) and individuals who have been diagnosed with a Traumatic Brain Injury (TBI) present similar academic and functional difficulties. Attention, memory, language, cognitive skills and emotional/ behavioral functioning are some of the most common sequelae following onset of both TBI and ADHD (Semrud-Clickeman, 2001; Barkley, 1998).

Despite the commonalities among these two disorder, the neurological genesis of the disorders obviously differ. TBI, especially moderate or severe TBI, is considered a more severe and diffuse neurological condition than ADHD. Therefore individuals with TBI should demonstrate more diffuse cortical and subcortical sensory-motor impairment. Analyzing the different neuropsychological profiles of these disorders, including sensory and motor functioning, could assist neuropsychologists in the process of differential diagnosis and guide future research.

The purpose of the current study was to investigate the sensory and motor functional differences of individuals diagnosed with ADHD from individuals who have experienced a TBI using to the *Dean-Woodcock Sensory Motor Battery* (DWSMB; Dean & Woodcock, 2003). The DWSMB yields three factors: simple sensory skills, motor and complex sensory skills, and subcortical motor skills and auditory/visual acuity (Davis et al., under review).

The authors hypothesized that more severe cortical and subcortical sensory-motor differences would emerge in the group with a TBI.

Methodology

The current study examined a group of 40 individuals (mean age = 17 years, 6 months, standard deviation = 6.16 years) with a diagnosis of ADHD and a group of 40 individuals with a diagnosis of a Traumatic Brain Injury (mean age = 20 years, 10 months; SD =11.2). Each of the 80 individuals had been referred for a neuropsychological assessment and were administered all 35 subtests from the *Dean-Woodcock Sensory Motor Battery* as part of a comprehensive evaluation.

Sensory-Motor Subtests	<u>Mean</u> <u>CYA</u>	<u>Mean</u> <u>TBI</u>	<u>F</u>	<u>P</u>
Visual Acuity-R	444.42	445.43	.049	.825
Visual Acuity-L	443.55	447.63	.816	.369
Visual Conf-R	484.42	476.37	3.655	.060
Visual Conf-L	486.70	479.70	2.912	.092
Visual Conf- B	487.2	480.15	3.912	.051
Auditory Percept-R	481.28	470.95	10.193	.002*
Auditory Percept-L	486.72	478.75	4.853	.031*
Auditory Percept-B	491.00	484.75	5.291	.024*
Palm Writing-Dom	499.8	487.90	8.970	.004*
Palm Writing-Non	499.7	488.50	7.490	.008*
Object ID-R	492.15	485.28	5.784	.019*
Object ID-L	496.35	487.80	7.553	.007*
Finger ID-R	489.55	479.95	9.581	.003
Finger ID-L	490.35	481.53	7.850	.006
Sim Loc-R hand	509.60	506.10	1.602	.209
Sim Loc-L hand	509.60	505.30	2.297	.134
Sim Loc-B hand	514.00	510.50	2.531	.116
Sim Loc-R hand & cheek	522.85	512.83	6.928	.010*
Sim Loc-L hand & cheek	522.90	513.75	6.106	.016
Sim Loc B hand & cheek	516.43	507.73	7.507	.008*
Gait & Station	485.65	472.23	12.8	.001*
Romberg	496.67	481.35	7.850	.006*
Clock Construction A	490.45	478.78	8.007	.006*
Clock Construction B	492.12	479.90	9.909	.002*
Finger-Nose R	489.93	479.35	3.706	.058
Finger-Nose L	489.68	478.05	4.816	.031*
Hand-Thigh R	483.50	468.1	12.262	.001*
Hand-Thigh L	483.48	470.72	6.616	.012*
Mime Movements	497.62	491.08	5.270	.024*
L-R Movements	498.55	491.85	4.080	.047*
Finger Tapping-Dom	502.85	498.63	6.297	.014*
Finger Tapping-Non	503.40	496.93	8.769	.004*
Expressive Speech	493.87	482.25	10.912	.001*
Grip Strength- Dom	530.28	521.48	2.755	.101
Grip Strength- Non	528.43	517.92	4.034	.048*

* Indicates statistical significance at .05 level

Results and Summary

The results of a Multivariate Analysis of Variance (MANOVA) indicated that the change in the combined dependent variable of the 35 variables of the DWSMB was significantly related to diagnosis, Wilks' Lambda = .011, $F(35, 44) = 2.081$, $p < .05$.

Overall, the group with ADHD performed better than did the group with TBI on 25 of the 35 subtests and across three broad factors of the DWSMB. Subsequent univariate tests found significant differences among 5 of the 11 Simple Sensory tasks which included finger identification and simultaneous localization of hands and cheek. Differences were seen among 14 of the 15 Cortical Motor and Complex Sensory tasks which included tasks of grip strength, finger tapping, hand writing coordination, construction, object identification, palm writing, motor movements and speech. Finally, 6 of the 9 Subcortical Motor and Auditory/Visual Acuity tasks revealed differences. Differences were found in gait and station, Romberg test, auditory acuity, and finger to nose coordination. Tests of near point visual acuity and visual confrontation were not found to differ between the two groups.

This study supports the hypothesis that TBI is a more severe condition which results in more diffuse impairment than does ADHD. The individuals in this study who have experienced a TBI had more impairment on a variety of cortical and subcortical functions, especially, more difficult complex sensory and motor tasks. Indices of Cortical Motor and Complex Sensory Functions can aid in the differential diagnosis of individuals who have ADHD from TBI. This finding is likely to be true of individuals with moderate to severe TBI. Future research should focus on comparisons between individuals with ADHD and mild TBI.

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