

Are impairments in sensorimotor processing associated with Developmental Coordination Disorder in Asperger's syndrome?

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Introduction

Asperger's syndrome (AS) has been studied thoroughly during the last few decades. One area that has been debated is whether people with AS are clumsy and whether they are at risk for dyspraxia or Developmental Coordination Disorder (DCD). Previous studies have given useful information but have also yielded inconsistent results. The current study aims to define dyspraxia and to establish whether people with AS have problems with motor coordination. The study also explores if deficits in sensorimotor processing may be a critical factor in the aetiology of DCD in AS. In addition, using Central Coherence tests the study investigates any possible links between sensorimotor processing & Central Coherence where people with autism spectrum disorders have superior performance known as Weak Central Coherence (WCC).

Hypotheses

- People with Asperger's syndrome have impaired motor skills leading to DCD.
- People with Asperger's syndrome have a deficit in sensory processing (proprioceptive & vestibular).
- People with AS who have a deficit in sensory processing (proprioceptive & vestibular) have relatively higher scores in WCC.

Methods

Design

The study is a single factor design between participant groups, looking at differences in the performance on the tests. The independent variables are the tests and the dependent variable is the level of performance

Participants

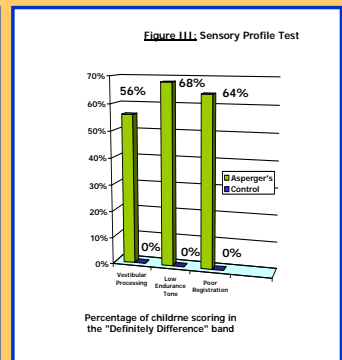
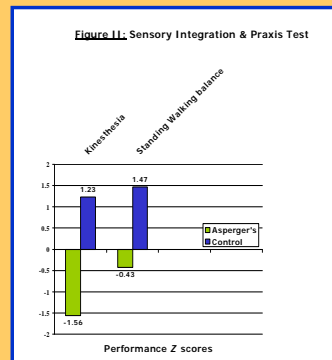
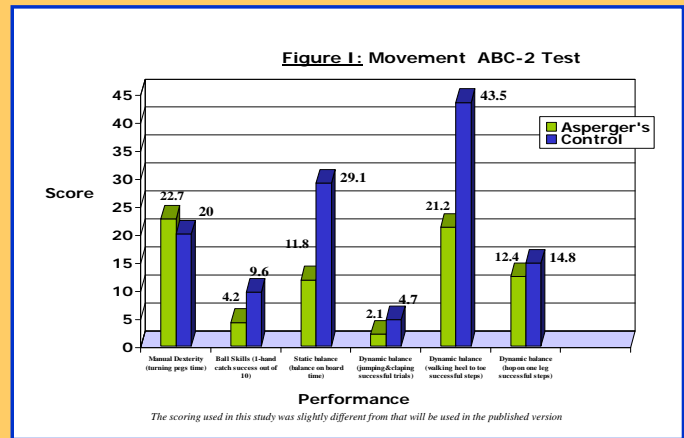
A group of 25 children aged 11-14 years old diagnosed with AS are compared neurobehaviourally with a control group of typically developing children, matched on verbal IQ and socio-economic status.

Apparatus/Materials

- **The Movement Assessment Battery ABC-2 (standardisation version):** Assesses motor performance of participants. It consists of two parts:
 - 1) *Motor performance test* individually administered.
 - 2) *The Movement ABC checklist* completed by an informant who has knowledge of the person's everyday functioning.
 The checklist is used as a screening instrument followed by the Motor Performance test, a more detailed assessment. The test assesses manual dexterity, ball skills and static and dynamic balance.
- **Sensory Integration Praxis Test (SIPT), 1989:** Shows how children organise and respond to sensory input. The SIPT measures visual, tactile, vestibular and proprioceptive perception (kinaesthetic) as well as motor performance.
- **Sensory Profile Test (1999):** Determines how well children process sensory information in every day situations and profiles the sensory system's effect on functional performance. It evaluates taste/smell, movement, visual, touch and auditory processing and activity. It is applicable to people with or without disabilities and has classification system that includes normative information.
- **Central Coherence Tests:**
 - 1) *Block Design subtest of Wechsler Abbreviated Scale of Intelligence (WASI), 1999:* Involves designs with very strong Gestalt qualities, that require the breaking up of line drawings into logical units thus individual blocks can be used to reconstruct the original design from its separate parts.
 - 2) *The Embedded Figure Test (1971):* Involves spotting a hidden figure (e.g. a triangle) among a large meaningful drawings (e.g. a clock).

Results

- The preliminary results of the study present significant lower motor performance by children with AS in the majority of the subtests of the Movement ABC motor test (**Figure I**). They either need more time than the control group to complete a task or they do not complete the task successfully [$p < 0.05$].
- On the Sensory Integration Praxis Test people with AS present with disturbed sensory abilities and performance (**Figure II**). They demonstrate significantly impaired performance in the Kinaesthesia and in the Standing Walking Balance sub-tests that require proprioceptive & vestibular processing. [Kin: $t(50) = -5.84$; $p < 0.001$; SWB: $t(50) = -12.39$; $p < 0.001$].
- Using the Sensory Profile Test (**Figure III**), high percentages of participants with AS had evidence of impaired sensory processing. These impairments involve vestibular processing, poor registration of sensory information, and low endurance & tone.
- The analysis of the data from Movement ABC motor test and Sensory Integration Praxis Test (**Table I**), found a positive correlation between motor and sensory (proprioceptive vestibular) subtests only in the AS group. It seems that when there is low performance in motor subtests there is more detectable low performance in the sensory tests like Kinaesthesia and Standing and Walking Balance subtests. Generally the associations are more apparent with low performances.
- Surprisingly there was not significant difference on the Block Design Test [$r(50) = 2.12$; $p = 0.698$]. In contrast participants with AS had significantly better performance at the Embedded Figure Test as was expected [$r(50) = 2.12$; $p = 0.048$].
- There is not any correlation between performance of the participants in the Embedded Figure Test and sensory processing tests (SIPT) [$p > 0.05$].



walking heel to toe backwards (Mov. ABC) WITH Standing & walking Balance (SIPT)	AS: $r = .472$, $n = 25$ $p = 0.017^*$ Control: $r = -.059$, $n = 25$ $p = 0.778$ Motor with Vestibular Proprioceptive
hopping on the mats (Mov. ABC) WITH Kinaesthesia (SIPT)	AS: $r = .448$, $n = 25$ $p = 0.025^*$ Control: $r = -.013$, $n = 25$ $p = 0.952$ Motor with Proprioceptive
hopping on the mats (Mov. ABC) WITH Standing & walking Balance (SIPT)	AS: $r = .398$, $n = 25$ $p = 0.049^*$ Control: $r = -.307$, $n = 25$ $p = 0.136$ Motor with Vestibular

* significant at $p < 0.05$

Conclusions

According to the preliminary data:

- Participants with AS have significantly impaired motor performance, providing support for the observation that people with AS have problems in motor coordination.
- In addition participants with AS present impaired proprioceptive & vestibular processing.
- The performance of participants with AS in motor tests is positively correlated with their performance in vestibular and proprioceptive sensory tests.
- However, this preliminary analysis could not establish a connection between sensory processing (proprioceptive, vestibular) and Weak Central Coherence though, this data is at present part of an initial exploratory study and requires further study.

Acknowledgments

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