Survey of Behavioral Problems and Sensory Processing in Children with Attention Deficit/Hyperactivity Disorder

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ABSTRACT

Objectives: All individuals need to have the ability of appropriate sensory processing for proper functioning in the environment and participation in daily activities. Moreover, behavioral functions can be affected by sensory processing problems. This study aimed to determine the relationship between behavioral problems and sensory processing in 7 to 10 years old children with Attention Deficit/Hyperactivity Disorder (ADHD).

Methods: This descriptive (cross-sectional) study included 60 children with ADHD aged 7 to 10 years, who were referred to a comprehensive psychiatric center. Short Sensory Profile (SSP) and Child Behavior Checklist (CBCL) questionnaires were used for assessing the patterns of sensory processing and behavioral problems in the patients.

Results: There was a negative correlation between internalizing behavioral problems (r=−0.426) and externalizing behavioral problems (r=−0.465), and the total score of sensory processing in ADHD children (P<0.05).

Discussion: The findings of this study showed that some behaviors in children with ADHD could be due to certain defects in their sensory processing.

1. Introduction

Attention Deficit/Hyperactivity Disorder (ADHD) is a neuro developmental behavior disorder that is defined based on the diagnostic criteria of the fourth edition of the Diagnostic Statistical Manual of mental disorders[1]. ADHD is known as a persistent pattern of inattention or severe hyperactivity, which is more frequent than what is typically seen in children with the same level of maturity or evolution [1].

In the United States, 4 to 12% of children aged 6 to 12 years suffer from this disorder [2]. The prevalence of ADHD in Tehran (Iran) was reported to be about 3 to 6% in children aged 7 to 12 years in 2002 [3]. ADHD is one of the major risk factors in the implementation of educational activities and psycho-social adjustment, as more than half of the children with ADHD have sufficient diagnostic criteria for psycho-social and behavioral disorders.

1. DSM-IV

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Hyperactivity is often associated with anxiety disorders, mood disorders, and poor adaptive skills [4]. Children with ADHD have characteristics such as irritability, voyeur, agitation, disorderedness, aggressiveness, stressful, and emotional. Such children are more likely to suffer from emotional, social, and behavioral problems and will also face a lack of confidence, anxiety, and depression [5].

Researchers and clinicians have shown that children with ADHD are constantly affected by defects in sensory processing in general and deficits in sensory modulation specifically [6-8]. Sensory processing refers to the central and peripheral nervous systems that manage incoming sensory information including the reception, adjustment, integration, and organization of sensory stimuli [9]. Using physiological and behavioral assessments, researchers have tried to explain the way children with ADHD respond to sensory stimulations. There are some physiological assessments of children with ADHD such as Somatosensory Evoked Potential (SEP) [8] and Electrodermal Reactivity (EDR) [7]. These assessments indicate that a significant percentage of these children show some differences in sensory reactions compared to children without ADHD at the same age. The possibility of defects in sensory processing in children with ADHD has also been reported in several other studies [10-14].

Behavioral problems are important in children with ADHD [5]. Various behavioral assessments, using parental questionnaires and Child Behavior Checklist (CBCL), show increasing sensitivity of children to sensory stimulation such as tactile, taste, visual and auditory senses [15-18]. In addition, other studies suggest that children with ADHD have vestibular and somatosensory dysfunctions in balance, postrotary nystagmus and tactile distinction, and recognition [8, 19]. There are only a few studies that have investigated the relationship between sensory processing disorders and behavioral problems in children with ADHD.

Mangeot et al. [4] evaluated 26 children with ADHD and 30 children without ADHD in the age group of 5-13 years through Short Sensory Profile (SSP), CBCL, and EDR and showed that children with ADHD have more sensory processing disorders than children without ADHD according to parents' reports and physiological assessments. Children with ADHD significantly obtain lower scores subtests of SSP, especially in seeks movement sensation, auditory filtering and tactile, taste/smell, and visual/auditory sensitivity. Furthermore, more variety was seen in the sensory response of these children in the subtest of SSP except for auditory filtering. A significant relationship was seen between sensory processing problems and high levels of aggression, and tactile sensitivity and subscales of aggressive behaviors and somatic complaints [4].

Studies on other psychiatric diagnoses such as Pervasive Developmental Disorders (PDD) have shown difficulty in sensory processing similar to ADHD. Tseng et al. [20] evaluated emotional, behavioral, and sensory processing problems in 67 autistic children aged 4 to 6 years and compared them with 45 children of the same age group without autism. They found that 95.8% of autistic children who had a significant internalization problem in at least one part of SP showed a significant difference while 81.8% of those who had externalization problems in at least one part of SP showed a significant difference.

Normal children at the same age had lower rates (66.7% and 40%, respectively). Their study determined factors that affect the emotional and behavioral problems in autistic children [20]. Since studies in this context are limited and incomprehensive, the present study was performed in Iran, for the first time, to determine the relationship between behavioral problems and sensory processing in children with ADHD.

2. Methods

This descriptive (cross-sectional) study included 60 children (aged 7-10 years) with ADHD who were referred to a psychiatric center. The inclusion criteria of this study were as follows: ADHD diagnosed by psychiatrists according to DSM-IV and the CSI-4 questionnaire, age between 7 to 10 years, residence in Tehran city (the capital of Iran), no obvious psychiatric abnormalities and neurologic disorders (according to patient's and parent's report), no pharmacological treatments, and at least four months of having taken medicines (if any). First, the objective of the study was explained, and written consent was obtained from parents of eligible children. Then, demographic characteristics were recorded, and the SSP and CBCL questionnaires were completed by the parents. Each participant was allowed to arbitrarily withdraw from the study.

The SSP questionnaire included 7 parts: Tactile Sensitivity (7 items), Taste/Smell Sensitivity (4 items), Movement Sensitivity (3 items), Seeks Movement Sensation (7 items), Auditory Filtering (6 items), Low Energy/Weak (6 items), and Visual/Auditory Sensitivity (5 items). Internal consistency between parts of this scale was 0.7 to 0.9. Internal validity correlations for parts were 0.25 to 0.76($P<0.01$). Preliminary studies on the validity of SSP showed a validity of more than 0.95 in children without sensory processing difficulties. The scoring of items was based on 5 degrees. The scores for each section and the overall score were reported. The range of overall scores

was 38 to 190, so that the scores ranging from 190 to 155 showed the normal function. The scores ranging between 142 and 154 and between 38 and 141 showed possible differences and significant differences in performance, respectively [21]. The Persian version of SSP was carried out for Iranianchildren 5 to 12 years of age in 2011in which the validity and reliability were above 90% [22].

The CBCL questionnaire is a tool that assesses a child's behavior by parents or caregivers using ascoring range of zero to three. This scale consists of 113 components, which give a total score. It also includes two dimensions: internalizing behavioral problems and externalizing behavioral problems. Based on the analysis by Achenbach and Rescorla, internalizing problems cover three scales such as anxiety/depression, withdrawal/depression, and somatic complaints. Externalization of problems involves breaking thelaw and aggressive behaviors [23, 24]. Finally, the data was analyzed using the SPSS software (version 22).

3. Results

In this study, the statistical test of Spearman's correlation coefficient was used to analyze the data due to the lack of normal distribution of data. There was a significant correlation between internalizing behavioral problems and the total score of sensory processing, and Low Energy/Weak and Visual/Auditory Sensitivity ($P<0.05$) (Table 1). In other words, the total score of sensory processing, Low Energy/Weak, and Visual/Auditory Sensitivity decreased if internalizing behavioral problems increase.

A significant correlation was not seen between internalizing behavioral problems and subscales like Movement Sensitivity, Taste/Smell Sensitivity, Seeks Movement Sensation, and auditory filtering ($P>0.05$). In children with ADHD, there was a significant negative relation between externalizing behavioral problems, and the total score of sensory processing and its other subscales. In other words, the total score of sensory processing and its other subscales decreased if externalizing behavioral problems increase.

4. Discussion

To the best of our knowledge, this is the first such study in Iran. This study aimed to determine the relationship between behavioral problems and sensory processing in 7-10 years old children with ADHD. The findings showed that sensory dysfunction in children with

Table 1. Correlation between sensory processing and behavioral problems in children with ADHD (Spearman's correlation coefficient).

Variable	Sensory processing	Number	Correlation coefficient	P-value
Internalizing behavioral problems	Tactile sensitivity	60	-0.197	0.132
	Taste/smell sensitivity	60	-0.229	0.078
	Movement sensitivity	60	-0.229	0.078
	Seeks movement sensation	60	-0.217	0.096
	Auditory filtering	60	-0.213	0.103
	Low energy/weak	60	-0.573	<0.001
	Visual/auditory sensitivity	60	-0.511	<0.001
	Total score	60	-0.426	0.001
Externalizing behavioral problems	Tactile sensitivity	60	-0.322	0.012
	Taste/smell sensitivity	60	-0.307	0.017
	Movement sensitivity	60	-0.064	0.625
	Seeks movement sensation	60	-0.543	<0.001
	Auditory filtering	60	0.438	<0.001
	Low energy/weak	60	-0.210	0.108
	Visual/auditory sensitivity	60	-0.348	0.006
	Total score	60	-0.465	<0.001

ADHD can affect the regulation of emotions and lead to behavioral problems. A significant relationship was seen between internalizing behavioral problems and externalizing behavioral problems, and the total score of sensory processing in these children ($P<0.05$).

Mangeot et al. [4] showed that children with ADHD have sensory processing problems more than children without ADHD at the same age. They also reported a significant relationship between sensory processing problems and high levels of aggression, and tactile sensitivity with aggressive behavior subscales and physical problems [4]. Stellar and Stellar [25] explained that several conditions are required to develop purposeful behaviors. Such conditions include an internal environment that supports the behavior, an external environment that provides reasonable opportunities, and a stimulus to initiate the behavior and opportunities for learning.

According to the principles of sensory processing, the internal environment is the ability of the central nervous system for processing and adjusting sensory data, and the external environment is sensory experiences showed by children in their daily lives. When children pay attention, they respond to specific sensory stimuli and are able to act. These children can have problems in the performance of their daily living due to a malfunction in any of these circumstances. If the central nervous system is unable to process sensory information, the child will be unable to learn about the environment and may seem inattentive [25].

The Dunn'smodel [26] of sensory processing states that children with ADHD with an avoidant sensory behavior have low neurological thresholds. They are resistant to changes and avoid non-familiar stimulus. These children often feel anxious or refuse to participate in the activities due to encountering new sensory stimulus. Anxiety or withdrawing from facing a severe sensory stimulation can cause internalizing behavioral problems. In contrast, children with sensory seeking behaviors show high neurological thresholds. They make a fuss and mutability and engage in unsafe behaviors to create sensory information due to their neurological needs. Thus, they often seem hyperactive, wacky, and aggressive, which suggest an increase in their externalizing behavioral problems [26].

5. Conclusion

Sensory processing has a large impact on individual's performance. Poor sensory processing in children with ADHD can affect their social, cognitive, sensory, and emotional development. Results obtained from this study showed that SSP can be used for the diagnosis, assessment, and intervention of sensory processing. The findings can help to understand sensory processing problems in these children, particularly for families and health systems to design the required planning for them. Early detection of the disorder in childhood can encourage them to successfully do purposeful activities.

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Conflict of Interests

The authors declared no conflict of interests.

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