A CASE-CONTROL EVALUATION OF SENSORY PROFILE AMONG PRESCHOOL CHILDREN AFFECTED BY AUTISM SPECTRUM DISORDER

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ABSTRACT

Background: Autism spectrum disorders (ASD) are neurobehavioral syndromes caused by a developmental disorder, biologically determined, with a very early onset and deficit mainly related to social communication and interaction. There is a considerable amount of literature on ASD suggesting abnormal sensory experience as a basic symptom, as also reported by the DSM-5 and ICD-10.

The current case-control study aimed to investigate the sensory perception skills in preschool children affected by ASD compared with a control group of typical developing children.

Materials and methods: The study sample was composed of 42 children, subdivided into two groups: 21 ASD (12 males); 21 typical developing (TDC) (10 males). All participants underwent the Bogdashina's Sensory Profile Checklist Revised (SPCR) to evaluate sensory perceptual abilities. ASD performance on SPCR was compared to TDC's.

Results: Individuals with ASD, showed significantly higher scores in all perception areas than TDC, except for the smell sub-scale, where the two groups were similar. The Cohen's d distribution showed a greater effect for vision, hearing, touch, vestibular and proprioception scales and a medium effect for smell scale.

Conclusions: ASD subjects have an abnormal interaction between auditory and somatosensory modalities, probably linked to a dysfunctional interaction between auditory and somatosensory systems associated with abnormal involvement of the non-classical auditory pathways. In this light, ASD children and adolescents present disorders in inter-sensory processing profiles when compared with TDC.

Keywords: Atypical sensory processing, Autism Spectrum Disorders, ASD, SPCR.

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Introduction

Autism spectrum disorders (ASD) are neurobehavioral syndrome caused by a developmental disorder, biologically determined, with a very early onset and deficit mainly related to social communication and interaction.

It has been widely reported in the literature the extreme clinical variability of the ASD, so much to be considered a "family of disorders" with similar basic characteristics but a great variability within it, so that in the DSM-5 was defined as Autism Spectrum Disorders (ASD).

Recently, several sensory-perceptive anomalies have been considered as the characterizing basis of this disorder in the different conceptions that have identified autism. Furthermore, several studies describe autism as a sensory disease, rather than a social dysfunction, in which isolation prevails and in which the brain does not properly organize stimuli.
All ASD symptoms can be traced to cerebral impairment that does not allow perceptual / sensory external inputs to be adequately perceived. In this perspective, autism can be considered a disorder of sensory integration that does not allow the brain to understand sensations, to elaborate them and organize them as perceptions\(^{(1\text{-}6)}\).

In line with the several researches, an abnormal sensory experience would explain the main symptoms of autism, those considered essential by DSM-5 and ICD-10\(^{(1\text{-}6)}\).

The current case-control study aimed to investigate the sensory perception skills in preschool children affected by ASD compared with a control group of typical developing children (TDC).

**Material and methods**

**Study design**

The present study has been planned as case-control study on children affected by autism spectrum disorder (ASD) vs. neurotypical development (TDC) paired subjects.

**Population**

Between May 2015 and December 2016, 21 ASD children were enrolled (12 males, 9 females) aged between 2.2 years and 5.9 years, (mean age 4.09 ± 1.83). ASD was diagnosed according to international criteria\(^{(1)}\).

Children affected by obesity, cognitive disability (IQ <70), epilepsy, chromosomal syndromes (eg. Down, Prader-Willi, Crouzon, Pierre-Robin), and psychiatric illness (ie. Psychosis; ADHD, selective mutism) or treated with psychoactive drugs were excluded\(^{(7\text{-}35)}\).

A control group consisting of 21 TDC (10 males, 11 females) (mean age 3.08 ± 0.87) was recruited for comparison of performance on SPCR.

All participants underwent the Bogdashina’s Sensory Profile Checklist Revised (SPCR) to evaluate sensory perceptual abilities\(^{(36)}\).

All parents gave written consent to participate to the study. The investigation was carried out in accordance with the principles of the Declaration of Helsinki\(^{(37)}\). The Internal Departmental Ethics Committee approved the study design.

**Bogdashina’s Sensory Profile Checklist Revised (SPCR)**

The revised sensory profile checklist (SPCR, Revised Sensory Profile Checklist) is a sensory profile screening tool for an ASD child. The ratings on which its indices are based are information taken from personal ASD reports and observation of the behavior of autistic children. The SPCR involves 20 categories on all seven sensory systems, to describe in detail all possible ways of sensory experiences in autistic people\(^{(36)}\).

This approach to the problem by "internal points out that not all the sensory experiences are abnormal, and some of them could be considered "super-ability" and represent strengths rather than weaknesses. The terms "narrow" to describe the different sensory perceptions have proved to be very useful in order to differentiate between the "unusual" perceptions that characterize the individual child, being closer to the deficit of each of them in respect of individual differences as strengths\(^{(36)}\). SPCR is filled in by the parents of the children. However, although the parent’s point of view is considered the main one, especially to describe the child’s sensory history and behavior at home, clinical or school observation is also taken into account to consolidate the information provided by the parents and to verify the points marked in the SPCR as "unsafe". The observation is carried out in the form of "episodic" sampling: when the target behavior is present a box must be ticked. The checklist of observations turned out to be very useful to allow a schematization and synthesis of the observations\(^{(36)}\).

**Statistical analysis**

For comparison between the two groups (ASD and TDC) the t- Student’s test and the and the Chi-square test, where appropriate, were applied. p values<0.05 were considered statistically significant.

Moreover, because of the relatively limited number of subjects recruited and in order to rule out possible type II errors, the effect size using Cohen’s \(d\) value was calculated. Cohen’s \(d\) is defined as the difference between two means divided by their pooled standard deviation. According to Cohen, 0.2 is indicative of a small effect, 0.5 of a medium effect size and 0.8 of a large effect size. p values<0.05 were considered statistically significant.

For statistical analysis the software STATISTICA data analysis software system, version 6, StatSoft, Inc. 2001 was used. The effect size was calculated with the online software Social Science Statistics (https://www.socscistatistics.com/effect-size/default3.aspx).
Results

The two groups are comparable for age (p = 0.882) and sex distribution (p = 0.757).

Table 1 and Graph 1 show the comparison between the two groups results in the SPCR, specifically, individuals with ASD, showed significantly higher scores on near all perception areas evaluated than typical developing children, while only for the smell subscale the two groups were similar (p=0.668).

Table 1: shows comparison between ASD and typical developing (TD) children among SPCR subscales: Vision, Hearing, Touch, Smell, Taste, Proprioception, Vestibular system scales. For the comparison between the two groups (ASD and TD) the t- Test was applied. The effect size analysis was performed (Cohen’s d). p values<0.05 were considered statistically significant. NS means not significant.

Table: A case-control evaluation of sensory profile among preschool children affected by autism spectrum disorder 2237

Discussion

The current study showed significantly higher scores on several SPCR subscales indices in ASD preschool children compared to TDC.

Specifically, these findings tend to pinpoint a relevant impairment in sensory skills in ASD subjects as shown in 2011 by Narzisi et al. with comparable results respect of the present study(38).

In fact, Narzisi et al.(38) studied sensory profiles in children with and without ASD. They reported statistically significant differences in auditory and tactile and multisensory processes, between the two groups of subjects. Furthermore, the Authors also found differences in sensory input modulation, which influence emotional and behavioral responses related to sensory processing. Our data would seem to confirm these results and show a compromise in vision, hearing, touch, proprioception and vestibular systems(38).

These data could be traced back to an abnormal cross-modal interaction between the auditory system and the somatosensory system, probably linked to the abnormal involvement of non-classical auditory pathways in ASD subjects.

In this light, ASD children and adolescents present disorders in inter-sensory processing profiles when compared with TDC.

Moreover, these findings about the sensory integration alteration have not a specific explanation, although an interesting study published in 2018 by Grafe et al.(39) highlighted the role of orexigenic system. In fact, they showed that in ASD animal models, lower levels of orexins tend to contribute to resilience to repeated social stress and that pharmacological inhibition of orexins increased social interaction behavior and decreased depressive-like behavior in the vulnerable population of rats(39).

Conversely, we can speculate that high levels of orexin tend to inhibit the social interaction behavior as showed by Messina et al. in 2018 in an autistic child with elevated plasmatic levels of Orexin A(40). The involving of orexinergic system in many relevant cognitive and executive functions are well characterized as not secondary in the management and evaluation of different neurodevelopmental disorders and of neurological and metabolic diseases with neurovegetative alteration(41-46).

We have take into account limitation of the present study:

• the relatively small size of recruited population of ASD preschool children;
• the lack of follow-up and of therapeutic engagement for the alteration in sensory skills.

On the other hand, our preliminary results are further reinforced by the high effect sizes and as such can be considered valid and strong.

In conclusion, we can suggest that ASD is a complex neurobiological syndrome that requires interdisciplinary approach and different and articulated instrumental and neurochemical evaluations as all the other neurological diseases(47-50).

References


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