

## Review Article

# Vision Impairment in Autism Spectrum Disorders

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**\*Corresponding author:** Bhaskaran S, Department of Paediatric Ophthalmology, Aravind Eye Hospital, India**Received:** March 09, 2020; **Accepted:** March 30, 2020; **Published:** April 06, 2020**Abstract**

Autism Spectrum Disorders (ASD) is a neurodevelopmental disorder characterized by impairments in communication, socialisation and stereotyped behaviours. Abnormalities of sensory perception have been considered as contributory causes of some characteristic features of ASD of which vision plays a major role. This article reviews the perceptual or cognitive visual difficulties encountered in children with ASD. Features of ASD overlap with behavioural features of congenital visual impairment which may lead clinicians to erroneously label children with vision impairment as autistic. Hence, a comprehensive ophthalmic examination including functional vision assessment is mandatory in children diagnosed with ASD.

**Keywords:** Autism; Blindism; Cerebral visual impairment

## Introduction

Autism Spectrum Disorders (ASD) is a neurodevelopmental disorder characterized by impairments in communication and social cognition, co-occurring with repetitive, stereotyped behaviours. The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) of the American Psychiatric Association defines ASD as “persistent difficulties with social communication and social interaction” and “restricted and repetitive patterns of behaviors, activities or interests” present since early childhood, “limiting and impairing everyday functioning” [1]. The Center for Disease Control and Prevention (CDC) estimates the prevalence of ASD in children as 1:68 (1 in 42 boys; 1 in 189 girls) [2]. Abnormalities of sensory perception have been invoked as possible primary or at least contributory causes of some characteristic features of ASD. Vision is a major sensory input in every growing child, and abnormalities in perceptual or cognitive vision may lead to secondary behavioural abnormalities or worsen existing autistic behaviour.

Cerebral/Cognitive Visual Impairment (CVI) in its broadest sense refers to a condition leading to misinterpretation of the visual world either with respect to where things are or concerning what things are [3]. Visual impairment, especially cerebral visual impairment in children with ASD, has yet to be studied in detail. The literature on vision-related problems in children with ASD is sparse, [4] and a comprehensive ophthalmological evaluation with appropriate interventions should be mandatory before the diagnosis is made. Traditional methods of ophthalmological examination may be challenging if the child is nonverbal or unable to understand typical communication. Functional vision assessments for identifying CVI are not typically performed, despite the fact that these abnormalities can have a profound effect on communication, education, and social-emotional development of the child.

## Visual Disorders in ASD

### Visual behaviour

Visual sensory symptoms are typically found in children with ASD which is broadly grouped as hyper and hypo. A non-exhaustive list of visual sensory symptoms as given by Bogdashina et al [5].

### Hyper:

1. Focusing on tiny pieces of dust/particles.
2. Dislike of the dark and bright lights.
3. Dislike of sharp flashes of light.
4. Looking down most of the time.
5. Covering/closing eyes at bright lights.

### Hypo:

1. Attracted to light.
2. Looking intensely at objects or people.
3. Moving fingers or objects in front of the eyes.
4. Fascination with reflections and/or brightly coloured objects.
5. Running hands around the edges of objects.

### Visual acuity

A recent study dedicated to solely assessing visual acuity has reported significantly greater visual acuity in a sample of 15 participants with ASD [6]. Though some studies showed higher incidence of refractive errors [7] in children with ASD, recent studies in India and other developing countries showed a 20% refractive error which is still higher than in general population, which is 3-4%. [8,9] Contrast sensitivity and colour vision were found comparable to typically developing children. Though they had no colour vision abnormalities, they showed strong preferences and aversions to certain colours [10].

There is growing evidence that individuals with ASD also experience atypical visual perception and demonstrate atypical visual exploratory behaviours [11]. In a study conducted in south India, Sahithya et al observed, the duration of fixation to a smiley face target was less than 5 seconds in children with autism whereas in typical children it was over 8 to 10 seconds. As the severity of autism increased the duration of fixation to smiley face in seconds reduced significantly [8]. The usefulness of this test as a screening tool in pre-

schoolers must be looked in to with larger studies.

### Visual discrimination

These children had a normal shape discrimination [12] and more than 80% children with ASD matched shapes on Lea 3D puzzles. However Ropar and Mitchell found difficulty in shape or form constancy in children with ASD [13]. This suggested that they are less influenced by prior knowledge in visual judgements.

### Visual closure

It is the ability to complete/ recognise an object partially hidden in view. Children with ASD performed well with objects or figures that were familiar, but had difficulty with unfamiliar or complex shapes. This may indicate difficulty in learning novel shapes [14].

### Ocular motility & Motion perception

The convergence response appears to be abnormal in across all forms of ASD. Restricted ocular motility; reduced optokinetic nystagmus; reduced smooth pursuit [4], reduced pursuit gain [15]; increased incidence of strabismus [16,17] and impaired saccadic suppression [18] have been reported in children with ASD. Despite normal contrast thresholds, these children encounter difficulty when presented with complex moving stimuli [19,20].

### Perception of faces

Children with ASD, have difficulty recognizing people. Face recognition in ASD has been widely studied and data from behavioural and neuroimaging studies confirm that impaired face processing occurs at an early age in ASD [1,2,21,22]. This difficulty is well beyond mere recognition of faces, it is impaired perceptual discrimination of faces and affects processing and understanding of emotional expressions [23,24]. More than 70 percent of children with ASD failed to recognise basic emotions when presented as emojis [8].

Poor processing of eye gaze and difficulty in reading or understanding facial expressions in ASD, owing to deficits in perception, might ultimately result in restricted socialisation and impaired communication which are hallmarks of ASD.

### Visual search

Children with ASD demonstrated superior performance to age matched controls when it came to visual search. When asked to pick up objects from a group of distractors or embedded figures, these children were much faster than age matched controls. Studies have demonstrated superior performance in tasks requiring recognition for details and ability to find hidden figures or recognition of fine details (local structure) [25].

In summary children with ASD may be suffering from perceptual visual impairments which may be partly responsible for their autistic behaviour. Literature has consistently shown that these children demonstrate superior processing of fine detail (local structure), impaired processing of a whole /global structure or contextual information and impaired motion perception [26]. Deficits in motion, size and shape perception, and visual closure affect reading, academic tasks, and daily activities, that may affect behaviour in the classroom and home resulting.

Children with ASD deserve comprehensive vision assessments to identify and lessen the effect of the disability. Persistent difficulties

with “social communication and social interaction” and “restricted and repetitive patterns of behaviors, activities or interests may be secondary to unrecognized cognitive/perceptual visual impairment” leading to further impaired daily functioning. A recent study further established cognitive visual impairment was present in children with ASD irrespective of their severity of autism [8].

### Blindism

Profound visual impairment present from birth or early childhood may lead to psychosocial and emotional disorders. 11–40% of children in this group show traits of autism. This is termed as “blindism” [27]. These secondary behavioural abnormalities mimic autistic behaviour and is more of a cross disability that must be differentiated from ASD. These children when identified early and provided with rehabilitation for visual impairment lose these autistic traits and develop typically.

It is also essential to identify and validate autism diagnostic tools so that clinicians can accurately diagnose autism in children with vision impairment and initiate appropriate interventions. Research to test typical autism interventions in children with vision impairment is minimal. Some behaviors viz., stereotyped hand movements, repetitive behaviour, absence of pointing, limited facial expressions occur commonly in children with congenital blindness especially in the early years. [28] Clinicians should be cautious of diagnosing autism in very young children with vision impairment, since it appears that symptoms may improve markedly over the course of development. [29] Before diagnosing ASD in a child with profound visual impairment, it is advisable to consider multiple sources of information such as clinical observation, parents interviews, using modified autism diagnostic scales like ADOS and ADI-R [30].

### Conclusion

Children with ASD have cerebral visual impairment independent of severity of ASD [8]. Children with profound visual impairment early in their lives if not rehabilitated for their visual impairment will develop autistic features and subsequently be characterized as ASD.

A comprehensive functional visual examination in children with ASD including not only typically measured optical and visual functions but also cognitive visual function may allow for the design of appropriate school and home-based services and interventions.

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