Visual acuity in children with autism spectrum disorder

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Abstract

Today, controversy still surrounds the acuity visual (VA) in adolescents and adults with autism spectrum disorder (ASD). ASD has been associated with hypersensitivity but recent studies have questioned these results. The aim of this study was to compare VA in children with ASD and typically developing children (TD). The study included 34 children: 12 with ASD [people living with (PW) ASD group: 1 female, 11 males] and 22 TD (PWTD group: 9 females, 13 males). The PWASD group was from the Clinica Mexicana de Autismo (CLIMA) and the PWTD group was from the *Aztecas* elementary school. VA was measured with Kay picture test cards for children without correction. Right eye VA of the PWASD group ranged from 0.2 to 1.0 (0.88±0.23) and left eye VA ranged from 0.2 to 1.0 (0.87±0.23). Right eye VA of the PWTD group ranged from 0.3 and 1.0 (0.84±0.23) and left eye VA ranged 0.3 and 1.0 (0.78±0.22). Non-statistically significant differences were found (t-test, P>0.05). Results support the view that visual acuity is not affected in children with ASD compared with TD children.

Introduction

The term autism comes from the word *autos* meaning *self*. Even though autism had already been recognized, it was only in 1943 that Leo Kanner first described autistic behavior in detail. Before Kanner, this type of behavior was generally known as child schizophrenia. Autism etiology remains an enigma for scientists. The most probable hypothesis is a central nervous system dysfunction. As far as vision is concerned, autists tend to have abnormal electrorretinograms, deficient visual-evoked potentials, and atypical optokinetic nystagmus. They also experience a higher occurrence than expected of strabismus, oculomotor deficiencies and refraction.[1] Autism appears to be a severe form of personality disorder affecting communication, imagination, planning and emotional reciprocity.

According to a 1996 study in the United States and metropolitan areas, the prevalence of autism was 3-4 for each 1000 children.[2] Between 1987 and 1998, there was a 273% increase in autism observed in the population of California, USA, according to the development services department report. This increase is due partly to a greater awareness on the part of all members of the community.

In 1975, Streff published the first publications mentioning the main optometric signs in autism, including normal binocular vision and defects in ocular motility. He also reported great limitations in visual contact and spatial relationships at relatively short distances.[3]

In 1977, Newsom and Simon studied nonverbal autistic children by means of an ordered simultaneous discrimination procedure to measure acuity visual (VA); 2 of these children were identified with important loss of VA.[4]

In 1989, the association between autism and Leber's congenital amaurosis (LCA) was investigated. It was found that both produce neurological damage but greater damage was found in LCA.[5]

In 1992, a study by Scharre evaluated vision dysfunctions such as ocular motility, VA and stereopsis in patients with autism and concluded that they did not present ocular diseases. Nevertheless, they found alterations in refractive errors and strabismus.[6]

In 1997, the pediatric department of ophthalmology at the Timamane hospital, Marseille, carried out a study on autistic children and found a large number of unilateral, bilateral astigmatisms and binocular vision problems.[7]

In 2002, Van der Geest Camfferman observed the relationship between the abnormal physical appearance of autistic children and their information processing; although they did not identify a clear relationship due to the inaccurate analytical methods used.[8]

In 2003, a study was conducted into visual attention in 2-year old autistic children. This study concluded that these children demonstrated ocular perception although there might be no ocular movement or the children did not follow the gaze of others.[9]

In 2007, two studies reported that some children with congenital blindness presented autistic behavior, depending on their etiology, genetics and pathology. However, this association is not very clear.[10,11]

Also in 2007, an investigation was carried out into speech audiovisual integration deficit and lip-reading in individuals with autism, how this may contribute to difficulties of speech, and its possible relationship with retarded early speech development.[12]

In 2008, a study determined that people with autism tend to have abnormal electroretinograms, deficient evoked visual potentials, and atypical opticokinetic nystagmus, besides a higher than expected incidence of strabismus and oculomotor deficiencies, refractive and binocular vision status.[13]

In 2009, a study was conducted using a psychophysical test of visual sensibility to human movement in relation to object movement in ASD. It found a higher visual sensibility to human movement, but suggested that ASD cannot adjust social visual information.[14]

Koh, Milne and Dobkins studied contrast sensitivity to 7 spatial frequencies obtaining measurements for 4 parameters; one of these was VA and it was inferred that there was no difference between autism spectrum disorder (ASD) individuals and controls for any of the 4 parameters measured. However, there was no evidence to support such a hypothesis.[15]

Franklin *et al.* conducted a study on ASD and color perception using the Frannsworth-Munsell Test with 100 test hues and found there was a general reduction in chromatic sensitivity. They concluded that there was a relationship with cortical models of perspective processing.[16]

Milne *et al.* studied many vision aspects, including VA. On average they reported significantly poorer results in both eyes in the ASD group compared with the typically developing group. However, data suggest that many aspects of vision, including VA, are unaffected in ASD.[17]

Sven *et al.*[18] found that people living with

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(PW) ASD did not have higher VA than either patients with schizophrenia or typically developing subjects. Tavassoli *et al.*[19] analyzed the VA in adults with ASD and adult controls and found no significant differences between groups.

Nevertheless, Ashwin *et al.*[20] analyzed VA in patients with autism spectrum disorder using Freiburg's VA and contrast test. Results showed that PWASD have a significantly better VA (20/7) than those not having this disorder (20/13), and Mark *et al.*[21] also find a better VA in PWASD (20/13) than controls (20/21).

Materials and Methods

The present study group included 34 children: 12 with ASD (PWASD group: 1 female, 11 males) and 22 with typically developing children (TD) (PWTD group: 9 females, 13 males). The ASD group is from the Clinica Mexicana de Autismo (CLIMA) and the TD group is from the *Aztecas* elementary school. Selection for the TD group was made by simple random sampling. The CLIMA and *Aztecas* elementary school are localized in a metropolitan area of Mexico City. All patients from the CLIMA had been diagnosed with ASD by psychologists. The VA was evaluated with Kay picture test cards without correction. The test cards were presented to the patient at a distance of 3 m. The patient did not have any distractions (colors, figures, persons not concerned with the test) while the test was being carried out. Only the child's therapist and optometrist were present during VA testing. All procedures were conducted according to the Declaration of Helsinki. We used SPSS 17 software for statistical analysis with independent sample Mann-Whitney test, related sample Wilcoxon's signed ranks test, paired sample t-test and linear regression models.

Results

Twelve children from the CLIMA (age range 6-12 years, mean 8±2.68) and 22 children from the *Aztecas* elementary school (age range 6-11 years, mean 8.36±1.53) were studied. Figure 1 shows frequency distribution in years.

Kolmogorov–Smirnov (K-S) test showed that VA values for right and left eyes in the PWTD group (P=0.002 and P=0.046, respectively) and VA values for right and left eyes in the total sample (P=0.00008 and P=0.005, respectively) were not normally distributed and thus no parametric tests were used. K-S test showed that VA values for right and left eyes in the PWASD group (P=0.092 and P=0.220 respectively) were normally distributed and parametric tests were used (Figure 1). VA of the PWASD group in the right eye ranged from 0.2 to 1.0 (0.88±0.23) and from 0.2 to 1.0 (0.87±0.23) in the left eye. Paired sample t-test showed no significant difference in VA between right and left eyes (t=0.561; P=0.586).

VA of PWTD in the right eye ranged from 0.33 to 1.0 (0.84±0.23) and from 0.33 to 1.0 (0.78±0.22) in the left eye. Related sample Wilcoxon's test showed a slightly significant difference in VA between right and left eyes (z=-1.833; two-tailed P=0.067).

Independent sample Mann-Whitney test found no significant difference in VA of the right eye between the PWASD and the PWTD groups (z=-0.507; two-tailed P=0.612) and no significant difference in the left eye between groups (z=-1.364; two-tailed P=0.173).

Discussion

Bölte *et al.*[18] and Tavassoli *et al.*[19] reported no significant differences between adolescent and adult controls and adolescents and adults with ASD. Milne *et al.*[17] reported that many vision aspects, including VA, are not affected in autism spectrum disorder in children. Our findings in children support their results.

Ashwin *et al.*[20] and Brosnan *et al.*[21] studied VA in 13 adolescent and adult males with ASD and compared their results with those of 13 adolescent and adult male controls. VA in the ASD group was better (2.85 decimals, 20/7) than controls (1.55 decimals, 20/13). The differences between these and our results depend upon the method and the distance used to measure the VA, and age and diagnostic classifications.

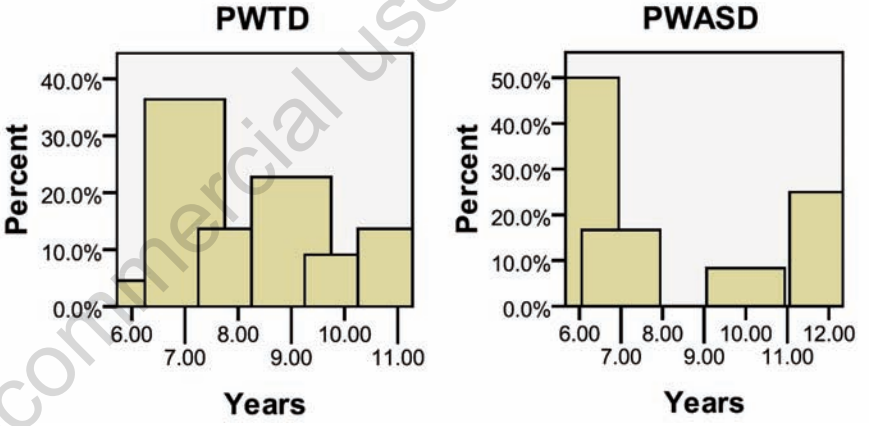

Figure 1. Age distribution in years. PW, people living with; TD, typically developing children; ASD, autism spectrum disorder.

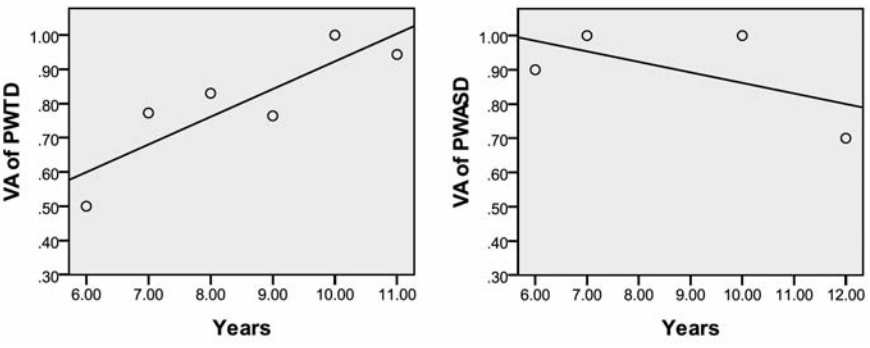

Figure 2. Average visual acuity (VA) according to age (years) for people living with autism spectrum disorder (PWASD) and typically developing children (PWTD).

The main limitation of our study is that, in the PWTD group, we did not use a questionnaire about the history of developmental or neuropsychiatric disorder, nor did we have data relating to the diagnostic classifications of ASD. Also, this study is limited by a small sample size, and further studies with more patients and including a full clinical case-history analysis are required.

Conclusions

The data suggest that there is no significant difference in VA between children with ASD and TD children for right and left eyes. Our results support the view that VA is not affected in children with ASD.

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