VISION PROBLEMS IN CHILDREN WITH INTELLECTUAL DISABILITIES

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Abstract: *Problems in visual functioning are one of the most common additional problems in children with intellectual disabilities. Nevertheless, they often remain undetected in children with intellectual disabilities, yet they affect development and learning. Therefore, to examine the prevalence and the kind of visual problems in children with intellectual disability we tested visual functions (visual acuity, contrast sensitivity, stereoacuity, oculomotor functions) in 25 children. All children had mild to moderate intellectual disabilities, and were between 7 and 13 years old. They all attended schools for children with intellectual disabilities.*

Results show that visual functions in most children were less developed than expected for their age, especially stereovision. Almost half of them had uncorrected refractive errors. We found some degree of low vision in seven children, according to results of visual acuity.

The results of this study indicate that functional vision assessment should be mandatory for children with intellectual disabilities, to detect visual problems, and provide timely intervention and adaptation of materials and methods

Key words: *vision problems, intellectual disabilities, low vision, visual functions*

INTRODUCTION

In population of children with developmental disabilities, we often notice that they have more than one disability. Problems in visual functioning are the most common problems in children with multiple disabilities, as well as in children with intellectual disabilities. Also, problems in visual functioning are more common in people with intellectual disabilities than in the general population (Das et al., 2010; O'Hara et al., 2010; Emerson and Baines, 2010; Warburg, 2001).

However, those problems in visual functioning often remain undetected or unrecognised in children with intellectual disabilities. Even mild problems in visual functioning can lead to additional problems in learning and everyday functioning, and all those problems tend to be explained by intellectual disability (O'Hara et al., 2010; Emerson and Baines, 2010; Oullette-Kuntz, 2005; Sutherland et al., 2002). Moreover, some behaviours that a child uses to compensate for specific problems in visual functioning tend to be misinterpreted, and sometimes described as stereotypic or maladaptive behaviours. Hence, the goals and the methods of education and rehabilitation used in teaching those children become inappropriate.

Data on prevalence of visual impairment in people with intellectual disabilities differ from study to study, depending on age, level of intellectual disabilities, diagnosis and the method of visual function assessment. Those surveys included mainly prevalence of visual impairments categorised as low vision and blindness, or prevalence of refractive errors (Das et al., 2010; O'Hara et al., 2010; Emerson and Baines, 2010). Nevertheless, most of them have shown that prevalence of visual impairment in people with intellectual disability is up to 30% (Das et al., 2010; Warburg, 2002). This prevalence is approximately 8.5 times higher than in the general population (Warburg, 2001). The prevalence of visual impairment among people with intellectual disability depends on the severity of intellectual disability, where people with mild intellectual disability have fewer problems in visual functions (2.2%) than people with profound intellectual disability, especially Down's syndrome (66.7%) (Splunder et al., 2006).

However, most of those data were obtained from surveys that included adults (18 years and older) with intellectual disabilities (Warburg, 2001; Warburg, 2002; Splunder et al., 2006). Hence, there are no sufficient data about prevalence of visual problems in children with intellectual disabilities attending schools, and especially about specific visual problems in those children. Akinci et al. (2008) included younger children with intellectual disabilities, from 1 to 17 years of age, in research about visual problems. However, they only reported about ocular problems (strabismus, nystagmus, refractive error), and gave no results about visual functions. Furthermore, Gogri et al. (2015) conducted research about visual impairment in children with different disabilities. They included young children with intellectual disabilities, aged 3 to 18 years in their survey, but they did not discuss the results of assessment since they realised that "children with intellectual disability were the most difficult to assess" and therefore they were very suspicious about the results obtained (Gogri et al., 2015).

Since most information needed for learning during education is perceived through vision, visual impairment and specific problems in visual functioning can lead to even more learning problems in children with intellectual disabilities. Therefore, it is necessary to analyse prevalence and type of visual problems in children with intellectual disabilities attending schools, in order to know how to adapt the goals and methods of education and rehabilitation to those children.

OBJECTIVES

The main objective of this research was to analyse prevalence of visual function problems in children with intellectual disabilities. Since visual function influences the performance and functioning in everyday tasks and learning in children, we also analysed the types of visual function problems in order to obtain information needed to adapt methods, materials and the environment.

METHOD

Data were collected through the project "Visual functioning of primary school children with intellectual and learning disabilities" supported by the Ministry of Science and Education of the Republic of Croatia. The project was approved by the Ethics Committee of the Faculty of Education and Rehabilitation Sciences, University of Zagreb. Written, informed consent was obtained from children's parents prior to assessments of functional vision.

Participants

We tested visual functions in 25 children with intellectual disabilities, 18 boys and 7 girls. Mean and median age of children was 10 years (range, from 7 to 13 years). Intellectual disabilities were in the range from mild to moderate in all children, with most children (20) having a moderate level of intellectual disability. All children lived with their families and attended schools for children with intellectual disabilities: the primary school "Nad lipom" or the Center for Education "Velika Gorica".

Instruments

Assessments were conducted from February until June 2016 in the primary school "Nad lipom" and the Center for Education "Velika Gorica", when children were in a familiar place. During each observation, two independent observers observed children's behaviour and answers on specific tests. Visual functions on which observers had different results were excluded from the study.

Basic visual functions (oculomotor functions, visual acuity, stereovision, contrast sensitivity) were tested binocularly, except near point accommodation, which must be assessed monocularly. All children who had prescribed correction were tested with the best possible correction. Tests and testing procedures were selected according to children's intellectual abilities. Since all children had intellectual disabilities we decided to use LEA symbol tests, on which they did not have to name the symbols but rather they could point at the same symbol on the model. Therefore, visual acuity was tested with the LEA SYMBOLS® Folding Pediatric Eye Chart for distance and the LEA SYMBOLS® Near Vision Card. In children who had low visual acuity results on tests where symbols were presented in line, we also used the single symbol test for visual

acuity (LEA SYMBOLS® Single Symbol Book). Contrast sensitivity was tested using the LEA SYMBOLS® Low Contrast Screener. Stereovision was tested using the Random Dot 2 Stereopsis Test with LEA SYMBOLS®. All mentioned tests were used according to test instructions (Good-Lite, 2017). Position of eyes was assessed following the procedure of the corneal reflection test (Hirschberg, 1881). Oculomotor functions (following eye movements and saccades) were tested by using meaningful targets as recommended by Irving et al. (2011). We used visual targets of the child's interest at a distance of 40 cm. To assess following movements, we used one visual target and moved it very slowly in different directions. Saccades were assessed by observing eye movements during switching fixation from one visual target to another. The child was asked to look at one target, which was named by the assessor, and then at another. Two independent observers estimated the quality of oculomotor functions. Accommodation was estimated by assessing the near point of accommodation, defined as the point closest to the eye at which a target is sharply focused on the retina. We used a small, meaningful target with a diameter of 1 cm attached to a ruler in front of the eye. The target was presented at the distance of 40 cm and moved slowly towards the eye. The child was asked to say when the target became blurry. This test was performed five times to get the average distance. Testing was done monocularly for both eyes.

Statistical data analysis

Obtained data were analysed using descriptive statistics available in the Statistical Package for the Social Sciences (SPSS). Due to the small number of participants in this study, we also conducted qualitative data analysis, using case study and phenomenology methodology.

RESULTS AND DISCUSSION

Results of visual function assessment have shown that most children with intellectual disabilities have problems in at least one visual function (Table 1).

We found asymmetric position of eyes in four (16%) children; two of them had esotropia, one had exotropia and in one child the position of the eyes was not consistent. Similar results have been reported in previous studies and they were in a range from 9.7% to 14% (Gogri et al., 2015; Akinci et al., 2008). Prevalence of strabismus in children from our study was slightly higher, but most children we assessed did not visit ophthalmologists for regular examinations, and some had never visited an ophthalmologist. Therefore, we believe that some of the cases of strabismus could have been treated in earlier years of life if the children had had regular ophthalmological examinations.

Table 1. *Incidence of visual function problems in children with intellectual disabilities*

Vision problem	Number of children (%)
Strabismus	4 (16%)
Smooth pursuit	7 (28%)
Saccades	5 (20%)
Convergence	8 (32%)
Near point accommodation	6 (24%)
Visual acuity lower than 0.4	6 (24%)
Stereovision	13 (52%)
Contrast sensitivity	2 (8%)
Nystagmus	2 (8%)

Despite the fact that only four children had no symmetrical alignment of eyes, 13 (52%) of assessed children had poor stereoacuity, or no stereovision at all; in other words, their results were worse than expected for their age (Birch et al., 2008). It is commonly known that children with strabismus have problems in depth perception due to poor or no stereovision. Nevertheless, when teachers meet children with symmetrical alignment of eyes they assume that the child has no problems in estimating distance and depth. Therefore, they tend to explain child's behaviours by invoking other disabilities. This happened with a child in our study. As his teacher explained: "He always yelled when he had to go to physical education, especially when asked to walk on the balance beam. He liked playing with a ball but he would hit it too hard." When we realised that he had no stereovision, the teacher said: "All this time, I was thinking that he was disobedient. Now I realise that some of his behaviours can be caused by vision problems." After that, teachers adapted their approach to the child when he had to go to physical education or play games with the ball. They gave him more sup-

port, knowing the reason for his behaviour and fear. Subsequently, according to the teacher, inappropriate behaviours have decreased in most situations, reflecting the fact that teachers understand the student and adapt the environment and materials.

There have been many studies on eye movements and visual scanning, since many authors relate them to learning, attention and cognitive processes, and they are required for proper intake of visual information (Ross and Ross, 1984). Nearly half a century ago, Ayres (1972) considered that smoothness of eye movements is an indicator of overall central nervous system integration. However, we are still lacking information about eye movements in children with intellectual disabilities. Mayberry and Gilligan (1985) in their study about visual pursuit included children with learning, intellectual disabilities and cerebral palsy. They concluded that all three groups of children had more problems in visual pursuit than the normative group. According to the results of visual function assessment in the present study, 7 (28%) children had problems in fixating steadily on a moving target, e.g. they did not have smooth eye movements during visual pursuit. In addition, 5 (20%) children had problems in switching fixation from one point to another, e.g. the saccades were inaccurate, slow or non-existent. A lot of children, 8 (32%) of them, showed insufficient convergence and near point of accommodation (N=6; 24%) for their age. All these visual functions are very important in sustained near-vision activities, like reading. Good oculomotor functions, especially saccades, are very important in visual tracking and processing of written text. Children with inaccurate saccades often lose the point of fixation, so tracking and processing of the text becomes very difficult. This leads to reading fluency decrease, which in children with intellectual disabilities is almost always explained by cognitive problems. Children with insufficient convergence and accommodation get tired quickly while reading, so they stop reading if the text is very long. This is usually explained by attention deficit disorder, which is common in children with intellectual disabilities. Since the results of our study showed high incidence of problems in visual functions important for reading, we can assume that those children are having problems in reading, not only because of intellectual disabilities, but also because of vision problems. Problems in reading caused by visual problems could be diminished with appropriate adaptations. Understanding the vision problems of these children, adapting reading materials, and helping them with time management could help them achieve better academic results and better self-esteem.

Results of visual acuity testing in children from our study identified 6 (24%) children with low vision that no one noticed before. All of them had visual acuity below 0.4 on both distances on near-vision tests with symbols presented in line. Nevertheless, 4 of them achieved better visual acuity results on single symbol vision acuity test (from 0.5 to 0.8). This brings us to the conclusion that they had problems not only with visual acuity, but also with visual clutter, which again can cause lower-level reading skills. Those children never complained about their vision. Some of them visited ophthalmologists as babies, and during this regular examination, the ophthalmologist found no problems. Their eyes and all parts of the eyes were well developed so they never went for ophthalmological exams again. After the assessment in the present study, they were referred to an ophthalmologist for comprehensive examination.

In five (20%) children, we found a large difference in visual acuity between distance and near vision (from acuity 0.2; 0.3; 0.4 to acuity 0.8; 0.1), yet those children wore no corrective glasses. As a result of these findings, those children were referred to an ophthalmologist to be prescribed glasses.

During assessments, we found only two children who had contrast sensitivity results lower than expected for their age. Also, only two of the assessed children had horizontal nystagmus, both with low frequency and small amplitude.

Besides the problems in visual functions, we suspected several children (N=4) had cerebral visual impairment, according to their behaviour and teachers' observations. We explained vision problems caused by cerebral visual impairment to teachers and recommended to them some strategies that would improve children's visual functioning

in activities. After some time applying these recommendations in their work, teachers noticed the difference in children's behaviour and achievement. As one of the teachers said, "I didn't need to adapt classroom or materials much, or change my approach much. Most of those things I was already doing, but now I know exactly how some adaptation helps, why this is relevant and, what is most important, I understand the behaviour of my student." Nevertheless, to be sure about vision problems in those children and to establish a diagnosis of cerebral visual impairment, we need an interdisciplinary approach and comprehensive assessment involving an ophthalmologist, child neurologist and low vision specialist. Also, teachers indicate that they need more information about cerebral visual impairment to be able to recognise these kinds of problems.

Although we included only 25 children with intellectual disabilities in our study, the results we obtained during assessments are similar to those from other authors assessing adults. Considering the needs of children and the remarks of their teachers, we must emphasise the importance of further studies, including more children. Those studies should explain the types of visual function problems, as well as their relation to visual functioning in different situations. This would help in understanding visual needs and in designing the best educational approach for children with intellectual disabilities and specific visual problems.

CONCLUSION

The results of visual function assessment conducted during this study in children with intellectual disabilities have shown that most of the children had problems in visual functioning. Most children had problems in stereovision as well as decreased visual acuity and problems in oculomotor functions important for near-vision activities, such as reading.

Since all children had intellectual problems, most behaviours connected to visual problems (lower-level reading skills, problems in estimating distance, quitting reading) were attributed to cognitive problems, disobedience or attention deficit.

Nevertheless, recommendations given after our assessments helped teachers to adapt materials, environment and methods, which, in their opinion, improved students' skills.

Therefore, we can conclude that visual functioning assessment should be mandatory for all children with intellectual disabilities in order to prevent non-recognition or misdiagnosis of children's problems. Misdiagnosis and incorrect interpretation of behaviours could lead teachers to use inappropriate teaching methods - ultimately to the dissatisfaction of children and the teachers themselves.

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PROBLEMI U VIZUALNOM FUNKCIONIRANJU DJECE S INTELEKTUALNIM TEŠKOĆAMA

Sažetak: *Problemi u vizualnom funkcioniranju među najčešćim su dodatnim poteškoćama u djece s intelektualnim teškoćama. Ipak, ovi problemi često ostaju neprepoznati i neotkriveni, a uvelike utječu na razvoj i učenje. Kako bismo ispitali učestalost i vrste problema u vizualnom funkcioniranju djece s intelektualnim teškoćama, procijenili smo vidne funkcije (oštrina vida, osjetljivost na kontraste, stereovid i okulomotoričke funkcije) u 25-ero djece s blagim i umjerenim stupnjem intelektualnih teškoća, kronološke dobi od 7 do 13 godina, polaznika škole za djecu s intelektualnim teškoćama.*

Rezultati su pokazali da su vidne funkcije većine djece razvijene ispod očekivanih rezultata u odnosu na njihovu dob, osobito stereovid. Gotovo polovina djece imala je refrakcijske greške koje nisu korigirane. Rezultati čak sedmero djece na testovima oštrine vida ukazuju na slabovidnost.

Procjena funkcionalnog vida mora postati obavezna za svu djecu s intelektualnim teškoćama, kako bi se na vrijeme prepoznale poteškoće u vizualnom funkcioniranju, osigurala pravovremena intervencija i učinila prilagodba nastavnih sredstava i metoda.

Ključne riječi: *problem u vizualnom funkcioniranju, intelektualne teškoće, slabovidnost, vidne funkcije*