

VISUAL ABILITY IN AMBLYOPIC CHILDREN COMPARED TO CHILDREN WITH NORMAL VISUAL ACUITY

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Vision rehabilitation in adults with low vision, even in children, is achieved with special devices, called low vision aids, LVA.

The aim of the study is to determine the degree of visual function in amblyopic children and daily activities that are best related to those of normally sighted peers with normal visual acuity.

The subjects were divided into two groups, matched 1:1 by age and gender: the first group consisted of 19 amblyopic children, and the second one consisted of 19 children with normal visual acuity. The questionnaire used to assess visual ability was Cardiff Visual Ability Questionnaire for Children (CVAQC), a reliable instrument for measuring visual ability in children with low vision. The study was conducted in the only rehabilitation center for amblyopic children in this region, so this is also a pioneer study.

The overall result of CVAQC in amblyopic children was 1.287 log vs. -2.956, representing statistically significantly poorer visual ability in comparison to peers without vision deficit ($p < 0.005$). Amblyopic children function best in entertainment activities, especially in listening music (-2.31 log); as for sport, these children report swimming to be their favourite activity (-0.99 log). In the field of education they show best results in language acquisition (-0.79 log) and the worst in mathematics (3.13 log). The greatest problem is reading small print texts books (2.61 log).

Low vision children have poorer result of visual function in comparison to their peers with normal visual acuity. A precise deficit assessment in the most important spheres of life can be determined by using the questionnaires, so the rehabilitation can be rightly chosen. *Acta Medica Medianae* 2016;55(1): 33-37.

Key words: low vision/amblyopia, low vision aids, rehabilitation of vision, CVAQC

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Introduction

Low vision is a vision deficit, meaning that best corrected visual activity in the better eye is less than 0.3 and higher or equal to 0.05 (according to Snellen test). In the true sense, a child with vision deficit untreatable with medication, surgery or optical correction has low vision. In childhood, low vision as a consequence of eye pathology (genetic or developmental anomalies) may have a cerebral origin in 27% (1) to even 45% (2) or 48% (3) children with low vision. It may be of retinal origin as well and also associated with other anomalies, as seen in 55% of children with low vision (4). Low vision imposes a problem concerning socialization, reduced education and children's participation in daily activities. Although

visual correction and visual deficit can be mathematically expressed, the real life of amblyopic children is not mathematics. In our modest clinical practice with low vision persons, patients have never been given measurements of quality of life influenced by low vision by the ophthalmologists. Namely, if a child has associated cerebral paralyses, best corrected visual acuity of 0.2 in the better eye, certainly has reading problem, too. On the opposite, a child in the absence of pathologic conditions, with the same visual acuity, has better reading results. With completed ophthalmic examination, it can be seen that both children have the same visual acuity, but different degree of functioning. That is why an examination by a defectologist is needed to complete the clinical picture of a child's visual function 33. Questionnaire instruments targeted at measuring the degree of visual deficit based on subjective perception of difficulties during the child's growth and development have been designed for amblyopic adults and children as well (5; 6).

Quality of life in children should be assessed by special instruments rather than questionnaires, since the quality of life questionnaires for adults do not meet the needs of children and adolescents

(5). This is especially true since low vision children are more or less dependent on others – school and family members. Few studies have been dealing with quality of life of children with low vision and have mainly been focused on certain conditions, like nystagmus or congenital cataract (7; 8). This is the reason that only a few questionnaires are used in clinical practice. One of the questionnaires is Children's Visual Function Questionnaire (CVFQ) (9), but with some limitations. Namely, it has two versions available, one for children up to 3 years of age and the other for children from 3 to 7 years of age. Children over the age of 7 cannot be tested. The questionnaire Impact of Vision Impairment for Children (IVI_C) was tested on 126 students aged between 8 and 18 years (10). However, except the quoted paper of the author, no published studies have used this instrument on the specific impact on vision deficit on children's QoL yet, although the authors agreed on its usefulness. The other two specially designed tests for children are LPV FVQ (Low Vision Prasad Functional Vision Questionnaire) (11) and Cardiff Visual Ability Questionnaire or Children (CVAQC) (12). The first one is used only in growing children not familiar with computers and electronic devices in developing countries and is not acceptable for children in European countries, regardless the fact that it has been tested on the largest sample size. The other questionnaire specially developed at the School of Optometry and Vision Sciences, Cardiff University, UK, is completely applicable for low vision European children.

Amblyopic children have to use special optical and/or electronic devices to help them to be, more or less, active in daily life, but this requires education and training (13). These devices are called Low Vision Aids-LVA. Low vision aids are magnifiers of different range (hand-held, static and electronic), then electronic systems with built-in software that allow text magnification, telescopes and prisms. Generally speaking, first time prescribed LVA device should be used up to the age of 8 the latest (14) in order to make reading and daily functioning possible (15).

Aim: the main aim of the study was to determine the degree of visual function in low vision children in comparison to healthy population without visual deficit, matched for age and gender. The other aims were:

- To determine the aspect of functioning the children find most and least difficult.
- To determine the degree of low vision impact on a child's quality of life.

It was hypothesized that amblyopic children generally have lower quality of life in comparison to their peers with normal visual acuity.

Material and methods

This research is a prospective observational clinical study. It enrolled amblyopic children aged between 6 to 18 years, with permanent residence in Montenegro. These children were the patients at the Ophthalmology Department, Children's Hospital, Clinical Center of Montenegro, registered by the Association for the Blind, or referred to the Department by ophthalmologists. The Department is the only one of the kind within the public healthcare system in the region and is equipped with sufficient number of reading LVAs: telescopes (LVA of magnification power from 2x to 8x), electronic lenses of magnification power from 2x to 24x with different degree of contrast potential, and prisms ready fit 2-16 pD base in. Then, there are devices for long distance viewing: telescopes of magnification power of 1.9x and 4.2x and optical devices in the form of lenses.

The study participants were children with voluntary and detailed informed consent concerning the type and method of investigation signed by their parents. The inclusion criteria were the best corrected visual acuity in the better eye less than 0.3 and greater or equal to 0.05 according to Snellen's test; children oriented in space and time and to people as well. The questionnaire was in mother tongue, understandable both to parents and children. Those who had difficulties in understanding were excluded from the study. The study exclusion criteria were the children's history of non-cooperation and severe mental retardation. The study was approved by the research ethics committee.

CVAQC score is shown as the total score and specific spheres of life score concerning education, short and long distance vision, getting around, social interactions, entertainment and sport. The control group comprised the same number of children, the total of 19 children with visual acuity of 1.0 according to Snellen's test, with no vision problems or any other ophthalmic disease. The subjects were age and gender matched, one amblyopic child matched with a child without vision deficit. The parents of the children from the control group also signed a voluntarily consent for study participation.

Native and best corrected visual acuity was determined in all the children included in the study. Visual acuity was determined using Snellen's optotype for older children, but in cases it was not possible to assess acuity in this way the Lea Symbols chart was used. Visual acuity is expressed as a decimal number and correction as spherical equivalent, the sum of the sphere and one half of the cylinder power. Each child had his/her ophthalmic and optometric chart. All the parents or guardians filled in a questionnaire about their child's general health facts. Low-vision children were given LVA upon determining the type and the strength of the vision aid. All the children underwent the Cardiff Visual Ability Ques-

Table 1: CVAQC in children with low vision compared to the controls

	education	near vision	distance vision	getting around	social interaction	Entertainment	sport
control group (SD)	-3.14	-3.48	-2.29	-3.53	-2.51	-2.23	-3.03
low vision children (log)	1.7	1.05	3.46	1.77	1.39	0.37	-0.62

Legend: SD – standard deviation; log–logarithm

tionnaire for Children (CVAQC) (12), approved by the author of the questionnaire. The result of the measurement was expressed in decimal notation in the range from 1 to 5 (1–accomplishment of tasks with no difficulties, 4– accomplishment with difficulties and 5–no answers). The author recommended special software charts to express the given tasks as logarithms representing standard deviation for each question from the questionnaire. The children from the experimental group also performed reading speed tests using letter size N8 before and after LVA rehabilitation.

Results

The total of 38 children equally distributed into two groups, gender and age matched, were examined. The experimental group consisted of 19 low vision children and the control group included 19 children in the absence of visual deficit (mean age 13.2 ± 4.1 years, age range from 9 to 18 years). All the children met the study inclusion criteria. They were tested using the CVAQC questionnaire and answered the questions on their own or with the assistance of the parents.

The 25-item Cardiff visual Ability Questionnaire for Children comprises seven categories – education, near vision, distance vision, getting around, social interaction, entertainment and sport. The results expressed as standard deviation and a logarithmic function of standard deviations are presented in Table 1.

The overall result of CVAQC in low-vision children was 1.287 log (SD 1.26) and in the control group it was -2.956 log (SD 0.983), what is statistically significantly worse visual function in comparison to peers without visual deficit ($p < 0.005$).

Low vision children reported never watching a film at the cinema (only 3/19 went to the cinema) and never using public transport on their own but only with a companion.

The children from the experimental group showed the best results in the sphere of entertainment. All the children reported listening to music (score -2.31 log), playing computer games and using mobile phones (score 0.19 log to 1.14 log) as very easy. In the sphere of sport, swimming was found to be the favourite activity of amblyopic children (-0.99 log), but they avoid playing ball games or running (1.99 to 2.65 log).

In the sphere of education, language lessons are found to be the easiest (-0.79 log) and maths lessons the most difficult (3.13 log). The greatest problem is reading the small print in the textbooks (2.61 log), while drawing, colouring and painting is not so difficult (1.72 log). As for daily functioning and distance vision, amblyopic children reported reading the board in the classroom the most difficult (2.04 log), but watching television also poses a problem to them (2.26 log).

Low vision children demonstrated weaker social interaction in comparison to their peers with normal visual acuity. They like being with friends (0.84 log), but have problems in recognizing their faces while approaching them (1.65 log) or when they are at a playground (1.77 log). It is a distress for low vision children and they very often avoid making friends as not to feel embarrassed in recognizing and identifying faces.

Discussion

In daily activities with low vision children it is of extreme importance to pay full attention to quality of life to areas of functioning that require good vision. Two aspects should be distinguished: the first one is functional visual (how well the person functions in vision-related activities), and the second one is visual function (describes how well the visual system functions) (16). Both aspects impact and crucially limit the quality of life of people with low vision.

Instruments for measuring functional abilities of low vision children have to be easily understood by the individuals, easy to interpret, with as few questions as possible focusing on the most important functioning areas. Also, interpretation of rehabilitation outcomes with LVA is very important in assessing real needs of people with low vision, especially children (17). The questionnaire CVAQC used in this study fulfills all the criteria of validated measuring instruments. Low vision children enrolled in the study showed weaker achievements in all the spheres of functioning in comparison to their normally sighted peers, as shown by some other authors as well. They achieve the best results in the fields of music and language acquisition.

The second aspect of this study indirectly relates to organizing a high-need special low vision care services for children. A respectable journal

has recently published the result of a large sample size survey (total of 10033), suggesting that the greatest needs in general population are for eye care services, annual eye examination services, cataract surgery services and low vision services (18). The problem concerning special low vision services has been an on-going one recently, since there is a need for special education and training in all countries, regardless their economic development. Pioneer studies on this topic embraced experiences of three most developed societies and their low vision centers – Canada, Wales and England (19), but in the last few years a critical mass of publications has been achieved, suggesting the need for low vision services. The concept of low vision services has changed a lot over the last 50 years due to technological innovations and increasing number of low-vision people (20).

So, the significance of our study is in showing first results of a modern department for low-vision children, the first of the kind in the region.

Conclusion

Low children achieve weaker results in daily functioning in comparison to their peers with normal visual acuity. The lowest results are in the sphere of education, reading and mathematical tasks are the most difficult, but language lessons are the easiest. In the sphere of entertainment and sport they show best results in music and swimming, but the worst in ball games at the playgrounds. We believe that establishing rehabilitation centers for persons with low vision is a constant need aimed at improving lives of many patients, as proved by our experience.

References

- Durnian JM, Cheeseman R, Kumar A, Raja V, Newman W, Chandna A. Childhood sight impairment: a 10-year picture. *Eye (Lond)* 2010; 24(1): 112-7. [[CrossRef](#)][[PubMed](#)]
- Rahi JS, Cable N. Severe visual impairment and blindness in children in the UK. *Lancet* 2003; 362(9393): 1359-65. [[CrossRef](#)][[PubMed](#)]
- Rosenberg T, Flage T, Hansen E, Riise R, Rudanko SL, Viggosson G, et al. Incidence of registered visual impairment in the Nordic child population. *Br J Ophthalmol* 1996; 80(1): 49-53. [[CrossRef](#)][[PubMed](#)]
- Bodeau-Livinec F, Surman G, Kaminski M, Wilkinson AR, Ancel PY, Kurinczuk JJ. Recent trends in visual impairment and blindness in the UK. *Arch Dis Child* 2007; 92(12): 1099-104. [[CrossRef](#)][[PubMed](#)]
- Birch EE, Cheng CS, Felius J. Validity and reliability of the Children's Visual Function Questionnaire (CVFQ). *J AAPOS* 2007; 11(5): 473-9. [[CrossRef](#)][[PubMed](#)]
- Varni JW, Limbers C, Burwinkle TM. Literature review: health-related quality of life measurement in pediatric oncology: hearing the voices of the children. *J Pediatr Psychol* 2007; 32(9): 1151-63. [[CrossRef](#)][[PubMed](#)]
- Boulton M, Haines L, Smyth D, Fielder A. Health-related quality of life of children with vision impairment or blindness. *Dev Med Child Neurol* 2006; 48(8): 656-61. [[CrossRef](#)][[PubMed](#)]
- Pilling RF, Thompson JR, Gottlob I. Social and visual function in nystagmus. *Br J Ophthalmol* 2005; 89(10): 1278-81. [[CrossRef](#)][[PubMed](#)]
- Felius J, Stager DR, Sr., Berry PM, Fawcett SL, Stager DR, Jr., Salomao SR, et al. Development of an instrument to assess vision-related quality of life in young children. *Am J Ophthalmol* 2004; 138(3): 362-72. [[CrossRef](#)][[PubMed](#)]
- Cochrane GM, Marella M, Keefe JE, Lamoureux EL. The Impact of Vision Impairment for Children (IVI_C): validation of a vision-specific pediatric quality-of-life questionnaire using Rasch analysis. *Invest Ophthalmol Vis Sci* 2011; 52(3): 1632-40. [[CrossRef](#)][[PubMed](#)]
- Gothwal VK, Lovie-Kitchin JE, Nutheti R. The development of the LV Prasad-Functional Vision Questionnaire: a measure of functional vision performance of visually impaired children. *Invest Ophthalmol Vis Sci* 2003; 44(9): 4131-9. [[CrossRef](#)][[PubMed](#)]
- Khadka J, Ryan B, Margrain TH, Court H, Woodhouse JM. Development of the 25-item Cardiff Visual Ability Questionnaire for Children (CVAQC). *Br J Ophthalmol* 2010; 94(6): 730-5. [[CrossRef](#)][[PubMed](#)]
- Cox RF, Reimer AM, Verezen CA, Smitsman AW, Vervloed MP, Boonstra NF. Young children's use of a visual aid: an experimental study of the effectiveness of training. *Dev Med Child Neurol* 2009; 51(6): 460-7. [[CrossRef](#)][[PubMed](#)]
- Schurink J, Cox RF, Cillessen AH, van Rens GH, Boonstra FN. Low vision aids for visually impaired children: a perception-action perspective. *Res Dev Disabil* 2011 May; 32(3): 871-82. [[CrossRef](#)][[PubMed](#)]
- Lee SM, Cho JC. Low vision devices for children. *Community Eye Health* 2007; 20(62): 28-9. [[PubMed](#)]
- Colenbrander A. Assessment of functional vision and its rehabilitation. *Acta Ophthalmol* 2010; 88(2): 163-73. [[CrossRef](#)][[PubMed](#)]
- Massof RW, Stelmack JA. Interpretation of low-vision rehabilitation outcome measures. *Optom Vis Sci* 2013; 90(8): 788-98. [[CrossRef](#)][[PubMed](#)]
- Zheng Y, Cheng CY, Lamoureux EL, Chiang PP, Rahman AA, Wang JJ, et al. How much eye care services do Asian populations need? Projection from the Singapore Epidemiology of Eye Disease (SEED) study. *Invest Ophthalmol Vis Sci* 2013; 54(3): 2171-7. [[CrossRef](#)][[PubMed](#)]
- Leat SJ, Fryer A, Rumney NJ. Outcome of low vision aid provision: the effectiveness of a low vision clinic. *Optom Vis Sci* 1994; 71(3): 199-206. [[CrossRef](#)][[PubMed](#)]
- Ryan B. Models of low vision care: past, present and future. *Clin Exp Optom* 2014; 97(3): 209-13. [[CrossRef](#)][[PubMed](#)]

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doi:10.5633/amm.2016.0105**VIDNA FUNKCIONALNOST SLABOVIDE DECE U
ODNOSU NA VRŠNJAKE SA NORMALNIM VIDOM***Zorica Tončić¹, Nataša Jovović¹, Nataša Pojužina¹, Vesna Jakšić²,
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Rehabilitacija vida slabovidih osoba, pa i dece, vrši se uz pomoć specijalnih pomagala, tzv. LVA ili low vision aid. Cilj ove studije bio je da se utvrdi stepen vidne funkcionalnosti slabovide dece, odnosno u kojoj sferi svakodnevnog funkcionisanja imaju najpribližnije rezultate u odnosu na svoje vršnjake.

Ispitanici su bili podeljeni u dve grupe koje su međusobno bile ukrštene prema polu i uzrastu metodom 1 na 1: prvu grupu je činilo 19 slabovide dece, a drugu 19 dece sa normalnim vidom. Za procenu vidne funkcionalnosti slabovide dece korišćen je referentni instrument merenja Kardifski upitnik za procenu vida kod dece (eng. Cardiff Visual Ability Questionnaire for Children (CVAQC)). Studija je sprovedena u jedinom centru za rehabilitaciju slabovide dece u ovom regionu, te je ovaj rad i pionirski poduhvat.

Ukupan rezultat CVAQC slabovide dece iznosio je 1.287 log nasuprot -2.956 log, što je statistički značajno lošija vidna funkcionalnost u odnosu na vršnjake bez vidnog deficita ($p < 0,005$). Slabovida deca najbolje funkcionišu u sferi zabave, posebno slušanja muzike (-2,31 log), u sferi sporta slabovida deca se izjašnjavaju da najradije plivaju (-0,99 log). U oblasti edukacije, najlakše savladavaju jezike (-0,79 log), a matematiku najteže (3,13 log). Najviše problema imaju sa čitanjem sitnog teksta u knjigama (2,61 log).

Slabovida djeca imaju slabiji rezultat vidne funkcionalnosti u odnosu na svoje vršnjake koji nemaju problema sa vidom. Korišćenjem upitnika se tačno može precizno kvantifikovati deficit u najvažnijim sferama života slabovidog deteta i usmeriti rehabilitacija u pravom smeru. *Acta Medica Medianae 2016;55(1): 33-37.*

Ključne reči: slabovidost, low vision aids, rehabilitacija vida, CVAQC