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RECOGNITION OF SPECIFIC VISUAL BEHAVIORS ASSOCIATED WITH THE RISK OF CEREBRAL VISUAL IMPAIRMENT BY PARENTS AND TEACHERS

PREPOZNAVANJE SPECIFIČNIH VIZUELNIH PONAŠANJA POVEZANIH S RIZIKOM OD CEREBRALNOG OŠTEĆENJA VIDA OD STRANE RODITELJA I NASTAVNIKA

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ABSTRACT

Cerebral visual impairment (CVI) is a complex neurological disorder that significantly affects the visual functioning of school-age children, often unrecognized within educational settings. The aim of this study was to determine the presence and frequency of specific visual behaviors associated with the risk of CVI in lower primary school students, and to examine differences in their recognition between parents and teachers. The study included 112 students from grades three through five, with data collected using an abbreviated version of the *Screening for Cerebral Visual Impairment* questionnaire. The results indicated that parents recognize specific visual behaviors considerably more often than teachers. Although this difference did not reach statistical significance, a borderline trend was observed. The findings suggest a need for enhanced teacher training, strengthened collaboration with parents, and the introduction of systematic screening procedures to enable timely identification of children at risk for CVI.

Keywords: cerebral visual impairment, specific visual behaviors, visual difficulties

SAŽETAK

Cerebralno oštećenje vida (CVI) složen je neurološki poremećaj koji značajno utiče na vizuelno funkcioniranje djece školskog uzrasta, a često ostaje neprepoznat u obrazovnom okruženju. Cilj ovog istraživanja bio je utvrditi prisustvo i učestalost specifičnih vizuelnih ponašanja povezanih s rizikom od CVI kod učenika nižih razreda osnovne škole te ispitati razlike u njihovom prepoznavanju između roditelja i nastavnika. Istraživanjem je obuhvaćeno

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112 učenika od trećeg do petog razreda, a podaci su prikupljeni primjenom skraćene verzije upitnika *Screening for Cerebral Visual Impairment*. Rezultati su pokazali da roditelji prepoznaju specifična vizuelna ponašanja znatno češće nego nastavnici. Iako ova razlika nije dostigla nivo statističke značajnosti, uočen je granični trend. Nalazi ukazuju na potrebu za unapređenjem edukacije nastavnika, jačanjem saradnje s roditeljima i uvođenjem sistematskih postupaka skrininga kako bi se omogućilo pravovremeno prepoznavanje djece izložene riziku od CVI.

Ključne riječi: cerebralno oštećenje vida, specifična vizuelna ponašanja, vizuelne teškoće.

INTRODUCTION

Cerebral visual impairment (CVI) is a term used to describe visual impairment arising from damage or injury to the visual pathways and visual processing centers in the brain (Lueck & Dutton, 2015). It is considered the most common cause of visual impairment in children in developed countries (Genderen, Dekker, Pilon, & Bals, 2012). As a distinct form of visual impairment, it is caused by brain damage rather than ocular pathology, which sets it apart from other types of visual impairment (Greppin, 2024). This means that visual information is transmitted through the eye in the usual manner, but the brain is not always able to process and interpret it (Morse, 1999, as cited in Swift, Davidson, & Weems, 2008). CVI can encompass a broad spectrum of visual difficulties, ranging from the absence of light perception to normal visual acuity with concurrent cognitive visual dysfunction (Edmond & Foroozan, 2006). The visual difficulties associated with CVI are a consequence of disruptions in the visual projection and/or interpretation of visual input reaching the brain (Dutton & Jacobson, 2001). Children with cerebral visual impairment are broadly categorized into three groups. The first group is comprised of children with severe visual impairment; the second includes children who have visual impairment but use their vision functionally, and who may also be affected by additional cognitive and motor difficulties; while the third consists of children who likewise have visual impairment but use their vision functionally, with academic achievements that are approximate to or consistent with what would be expected for their chronological age (Philip & Dutton, 2014). It is important to emphasize that the visual abilities of children with CVI do not remain static. Children with CVI present unique visual characteristics, reflecting the varying types and locations of brain damage and the presence of co-occurring difficulties (Vučinić, Anđelković, Jablan, & Žigić, 2014). The CVI spectrum thus encompasses reduced visual acuity, visual field deficits, and oculomotor problems in combination with cognitive visual dysfunction, mediated by two visual processing pathways: the ventral and dorsal streams (Genderen et al., 2012). Where damage to the dorsal or ventral visual streams has occurred in children with CVI, difficulties in day-to-day functioning within both the school and home environments are to be expected. Environmental adaptations, among other interventions, are necessary to support improved visual functioning in these children (Roman-Lantzy, 2007, as cited in Vučinić et al., 2014). The visual behavior of children with CVI varies from day to day, and even from hour to hour, which can at times give parents and teachers the impression that the child is being manipulative (Vučinić et al., 2014). From the foregoing, it may be concluded that cerebral visual impairment is a complex

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neurological disorder affecting the brain's capacity to process visual information, even when the ocular structures remain anatomically intact. In school-age children, the presence of CVI can give rise to numerous difficulties in everyday functioning, particularly within educational settings and in the acquisition of academic knowledge and skills, where a substantial proportion of information reception and processing relies on visual perception. As a result of visual processing difficulties, students with CVI may experience problems with reading, writing, shape recognition, tracking moving objects, spatial orientation, attention, coordination, and related functions. These difficulties are frequently misattributed to developmental or cognitive problems, which can delay timely diagnosis, early intervention, and appropriate support. The issue is further compounded by the fact that CVI may go unrecognized, as its symptoms vary and depend on the degree of impairment and the brain structures involved. Such difficulties have a negative impact on academic achievement, activities of daily living, orientation and mobility, students' self-confidence, and their social integration. Therefore, the aim of this study is to identify and determine the presence and frequency of cerebral visual impairment in lower primary school students, as well as to understand its manifestations and impact on students' everyday functioning, academic achievement, orientation and mobility, communication, and social integration — with particular emphasis on the identification of characteristic behavioral patterns, including visual behavior (visual fixation, visual field, visual attention, and the influence of familiar environments), the ventral stream, the dorsal stream, complex difficulties, other sensory modalities, and associated characteristics of cerebral visual impairment.

RESEARCH METHODS

Participants

The study sample consisted of parents and teachers of students from grades three through five (seven classes in total), comprising 112 students of the Gornji Vakuf Primary School in Gornji Vakuf – Uskoplje.

Measuring Instrument

Data were collected using an abbreviated seven-item version of the *Screening for Cerebral Visual Impairment* questionnaire[†] (Ortibus et al., 2011b), which allows for a rapid assessment of the likelihood of CVI within a very short administration time. The questionnaire is completed separately by both parents and teachers for each individual student in a straightforward yes/no response format, and it explores various characteristics of CVI by directing respondents toward the presence of specific visual behaviors that place a child at risk for CVI.

[†] Sonja Alimović, PhD (original professor), Matea Luburić, MA (Reahabilitation Education) and Andrea Paulik, MA (Reahabilitation Education) translated this questionnaire into Croatian with authors' consent

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Research Procedure

The study was conducted at the Gornji Vakuf Primary School in Gornji Vakuf – Uskoplje between May and July 2025. Class teachers arranged and held parent meetings, which opened with a brief informational session on the importance of recognizing specific visual behaviors, the purpose of the study, and its objectives. Parents completed the questionnaires during these meetings. For parents who were unable to attend due to justified reasons, questionnaires were sent to their home addresses. A separate meeting was also held with teachers, during which they were informed about the significance of identifying specific visual behaviors as well as the purpose and objectives of the study, and were asked to complete the questionnaire individually for each of their students.

Data Analysis Methods

The data were analyzed using SPSS version 20.0 (Statistical Package for the Social Sciences). Descriptive statistics and frequency distributions were used, with results presented in tabular form. Fisher's exact test was used to assess the equality of result distributions between groups.

RESULTS AND DISCUSSION

In order to identify and determine the presence and frequency of specific visual behaviors in lower primary school students, data provided by parents were used, given that they responded individually for each child. Their responses made it possible to gain insight into the individual behaviors of each child. Teachers, on the other hand, provided individual responses for each student within their respective class. In other words, the comparison of results between parents and teachers was conducted at the group level, that is, in terms of the total number of specific visual behaviors recognized, as well as for each variable individually, but at the level of the overall sample rather than at the level of the number of students identified as at risk. Of the seven lower primary school teachers covering grades three through five (112 students in total), only one specific visual behavior was identified as a risk indicator for cerebral visual impairment: *Specific Head Position*. In contrast, parents provided a total of 31 positive responses. The most frequently recognized variable was *Specific Head Position*, identified in eight children. This was followed by *Detection of Crumbs*, with seven responses. Parents further identified the variable *Everyday Objects* in six cases, while five parents responded positively to the variable *Other Senses*, indicating that the child explores the environment and space through senses other than vision. Four parents reported that their children have difficulty recognizing objects without color, recognizing only colored objects, and one child was identified as having difficulty recognizing fine details in images (Table 1).

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Table 1. Distribution of parent and teacher responses by specific visual behavior variables

	No. Of Behaviors Recognised - Parents	No. Of Behaviors Recognised - Teachers
Head Position	8	1
Everyday Objects	6	-
Colored Objects	4	-
Fine Details	1	-
Detection of Crumbs	7	-
Other Senses	5	-
Speech	-	-
TOTAL	31	1

Ortibus, De Cock, and Lagae (2011a) note that children with CVI who have sustained damage to the dorsal visual stream exhibit difficulties in managing complex scenes and three-dimensional space, as well as difficulties in visual search, visual guidance of movement of both the upper and lower extremities, visual attention, and motion perception. Lesions of the ventral visual stream are associated with difficulties in recognizing individuals by sight, impaired comprehension of facial expressions, difficulties in determining the position of the body and its parts in space, and various agnosias, including those affecting the recognition of color, shape, and object size, as well as difficulties in visual memory (Dutton, 2003; Vučinić, 2014; Shamman, 2009, as cited in Vučinić et al., 2014).

Damage to the dorsal visual stream produces visual field deficits such as hemianopia and inferior visual field loss, which affect reading, writing, communication, mobility, and feeding (McKillop & Dutton, 2008). Children with restricted visual fields may have difficulty moving through their environment safely and efficiently, negotiating obstacles, and frequently trip over low-lying objects. Within the classroom, such difficulties can lead to accidents, particularly in environments where excessive numbers of objects are present. Hemianopia and inferior visual field loss may each cause a child to trip over objects located on the side of the impaired field in the case of hemianopia, or over objects on the floor in the case of inferior visual field loss (McKillop & Dutton, 2008). The ventral visual stream also plays an important role in object, shape, and face recognition, as well as in route finding (Lueck, Dutton, & Chokron, 2019). Difficulties in these areas may result in a reduced capacity for mental imagery and visual conceptualization, which in turn can impede the development of environmental understanding and interaction (Dulin et al., 2008, as cited in Chokron, Kovarski, Zalla, & Dutton, 2020). Damage to the ventral visual stream may also manifest as difficulties in letter and word recognition (Dutton, 2003).

To analyze differences between parents and teachers in the recognition of seven specific visual behaviors in children, Fisher's exact test (two-tailed) was applied, thereby testing for any directional difference, whether parents recognize more or fewer behaviors than teachers. For the purpose of examining differences in the recognition of specific visual behaviors associated with the risk of cerebral visual impairment, the responses of parents and teachers were compared.

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Table 2. Overall distribution of parent and teacher responses

	Teachers-Yes	*Teachers-No*	*Total*
Parents-YES	1	7	8
Parents-NO	0	104	104
TOTAL	1	111	112

As presented in Table 2, parents identified behaviors in 8 students, while teachers identified only 1 behavior in a single student, who also represents the sole overlap between the two groups. In the remaining 104 cases, neither parents nor teachers reported the presence of any behavior.

Further analysis encompassed all seven behaviors (Table 3), of which parents recognized six and teachers only one. Fisher's exact test was used to assess the statistical significance of differences, given the small cell frequencies in the contingency table. The test was conducted on the basis of a contingency table.

Table 3. Overall distribution of responses by behavior

Group	Behavior Recognized	Behavior Not Recognized	Total
Parents	6	1	7
Teachers	1	6	7

Using the hypergeometric distribution for the exact given value of $p \approx 0.0714$, Fisher's exact test indicates a possible association (one shared student), but this does not reach statistical significance at the conventional threshold ($p > 0.05$); that is, agreement is present but insufficient to establish statistical significance. Nevertheless, given the small sample size and the clearly expressed difference in frequencies (six behaviors recognized by parents versus only one by teachers), this result may be interpreted as indicating a potentially lower level of sensitivity among teachers relative to parents in recognizing specific visual behaviors.

The findings reveal a pronounced difference in the rate of recognition of specific visual behaviors that may indicate a risk for CVI between parents and teachers. Although this portion of the study involved 112 primary school students from grades three through five, teachers identified only one specific behavior in a single student, in the category of *Specific Head Position*. Parents, by contrast, identified a total of 31 specific behaviors, including more subtle ones such as *Detection of Crumbs*, *Everyday Objects*, *Colored Objects*, *Other Senses*, and *Fine Details*. This discrepancy may be explained by the differing contexts in which parents and teachers observe the child. Parents have direct insight into the child's behavior across a variety of everyday situations (at home, during play, mealtimes, or dressing), where behaviors that are irregular or environmentally influenced are more likely to become apparent. Teachers, conversely, observe children within the limited and structured environment of the classroom, where attention is directed primarily toward educational tasks rather than toward the subtler aspects of visual functioning. The pronounced difference in observations

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underscores the real need for larger samples and further investigation in order to gain a deeper understanding of this gap.

In a study conducted by Williams et al. (2021), the frequency of specific visual behaviors associated with CVI was examined in children aged 5 to 11 attending regular primary school. The study also aimed to determine whether differences existed between parents and teachers in their assessment of specific visual behaviors that might indicate a risk for CVI. The results revealed substantial discrepancies in the ability of parents and teachers to recognize behaviors indicative of CVI. While teachers reported high scale scores in 11.8% of cases, the visual behaviors they assessed were not significantly associated with CVI. Parent-completed scale scores, on the other hand, demonstrated considerably greater diagnostic value: parents reported high scores in 9.8% of cases, and these scores were found to be statistically significantly associated with visual behaviors characteristic of CVI. In a study by Jackel, Wilson, and Hartmann (2010), which included parents of children with CVI, it was found that parents were the first to notice deviations in their child's vision in 55% of cases. According to the same study, ophthalmologists made the initial CVI diagnosis in 49% of cases, while educational rehabilitators identified unusual behaviors and referred the child for further specialist assessment in 17% of cases. Although the study was not focused exclusively on school-age children, it nonetheless serves as a useful indicator of the degree to which parents notice deviations in their child's vision.

The results of this study, as well as those of other studies, suggest that the recognition of CVI in the school context could be significantly improved through enhanced teacher training, as teachers' observations are currently directed primarily toward visible deviations, such as head position, while subtler indicators of visual difficulties go unnoticed. Furthermore, the findings underscore the need for closer collaboration between parents and teachers, since the integration of their respective observations has the potential to yield a more complete picture of a child's visual functioning.

CONCLUSION

Cerebral visual impairment (CVI) represents an increasingly prevalent cause of visual difficulties in children, yet its recognition remains a challenge for both healthcare and educational systems. Specific visual behaviors, although frequently subtle, may serve as early indicators of this complex neurological disorder. Within the school context, failure to recognize them leads to misinterpretation of student behavior, delayed diagnosis, and inadequate educational provision. The results of this study demonstrated that parents recognize visual deviations considerably more often than teachers. This finding points to a serious deficit in systematic monitoring and in the professional preparedness of educational staff to work with children who have functional visual difficulties. The findings further indicate a need for strengthening the awareness, knowledge, and competencies of educational professionals; for the introduction of screening instruments enabling rapid and straightforward identification of students at risk for CVI; for collaboration among healthcare, educational, and social service institutions; for interdisciplinary teamwork that includes parents; for the mandatory involvement of specialists from various professional backgrounds, particularly

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special educators and rehabilitation specialists, within the school system to ensure adequate support; for the adaptation of the school environment and learning materials; and, ultimately, for the raising of public awareness. We believe that such a combined approach has the potential to improve the monitoring of children with suspected visual difficulties, enable timely referral to specialist intervention, and ultimately enhance both their educational outcomes and their overall quality of life.

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