



# Children with Cerebral Visual Impairment (CVI)



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## Abstract

Cerebral visual disorders in children are usually summarized under the term “cerebral visual impairment” (CVI). These include homonymous visual field disorders, impairment of visual acuity, contrast and color vision, form vision, visual space perception, and object perception and recognition. Common causes of CVI are pre-, peri- and postnatal brain damage, vascular and inflammatory diseases and traumatic injury. In addition, genetic disorders of brain development can cause visual perception disorders. Diagnostic evidence is provided on the one hand by imaging procedures and medical information, on the other hand by a detailed examination of the various components of visual perception. Since children with CVI can also have functional impairments of the peripheral visual system and/or cognitive disorders, the reliable differential diagnostic classification of CVI can be difficult. A functional approach has proven helpful for the assessment of CVI, which takes into account the various aspects of visual perception as well as the cognitive components involved and the functional effects on individual life of children with CVI. Such a diagnostic procedure allows the assessment of retained and affected parts of visual perception, which is important for the use of individually suitable treatment methods, support and advice. CVI therefore requires a common, interdisciplinary diagnostic and therapeutic approach.

**Keywords:** Cerebral visual impairment; Cognition; Diagnostics; Support; Education

**Abbreviations:** CVI: Cerebral Visual Impairment; PCVI: Pediatric Cerebral Visual Impairment

## Introduction

The diagnostic term “Cerebral Visual Impairment” (CVI) includes all visual difficulties in children due to dysfunction of the central visual system [1-3]. However, because CVI can also occur in adults after acquired brain injury, Maino [4] has suggested the term pediatric cerebral visual impairment (PCVI). In about one third of children diagnosed with “low vision”, the cause is damage to the brain [5], and 10-40% of children who are examined in specialist pediatric institutions, show cerebral visual impairments [6]. However, although the number of children presenting with visual disorders due to brain damage or dysfunction appears to be relatively high, there are still no valid diagnostic criteria for CVI do still not exist. Therefore, a generally accepted diagnostic classification has still to be established [7]. Consequently, a reliable and binding differentiation between primary and secondary visual disorders, caused by non-visual factors, e.g., motivation (curiosity), attention and memory, does hardly exist, and can often be quite difficult. However, if one subsumes every form of impaired

visual perception under the umbrella term CVI, “CVI” loses its diagnostic significance and cannot serve as a valid basis for possible therapeutic measures. Ophthalmological measures, such as those conventionally used to characterize reduced vision, e.g., visual field and visual acuity, cannot always provide a (reliable) indication of the presence of CVI, because they are not always (significantly) changed [8,9].

## The diagnostic challenge of CVI

After reviewing the many criteria for CVI used in the scientific literature, Sakki et al. [10] have proposed the following definition as a consensus. “CVI is a verifiable visual dysfunction which cannot be attributed to disorders of the anterior visual pathways or any potentially co-occurring ocular impairment” (p. 431). For a reliable differentiation from other influencing factors, it appears necessary to take also into account other (secondary) impairment of visual perception, especially due to cognitive disorders. Up to 50% of children with the diagnosis CVI also show impairments

in cognitive domains, especially attention, memory and executive function [11-14]. Cognitive abilities are crucial for visual perceptual learning and for the formation of visual experiences and visual knowledge [1,3]. The strategy of ‘exclusion’ is a common procedure also in e.g., neuropsychological diagnostics, which has proven to be helpful for the classification of cerebral functional disorders. However, apart from exclusion criteria suitable and valid inclusion criteria are also required to characterize CVI. These criteria should address and include three main components: (a) evidence for the “C”, i.e., cerebral, (b) evidence for the “V”, i.e., visual, and (c) evidence for the “I”, i.e., impairment.

**C(erebral):** Diagnostic information to support the assumption of a cerebral cause of visual impairment comes mainly from two sources: medical history and imaging techniques. Medical history taking can provide important indications of brain damage before birth, at birth, or after birth [1,3]. Since milder forms of brain injury (lack of oxygen in premature or in complicated births) are often not documented and cannot always be reliably depicted with the help of imaging methods (e.g., [15,16]), a detailed anamnesis with the help of the mother is often the only source of information. Brain imaging techniques now allow reliable detection of morphological changes in the brain, e.g., in cases of malformations of the brain (Aicardi syndrome, pachy- and microgyria); moderate to severe hypoxia, periventricular leucomalacia (PVL), cerebrovascular disease, closed head trauma, and encephalitis [8,17]. Furthermore, CVI can also be part of a genetic syndrome [18]. In some developmental brain disorders, e.g., Down syndrome, Turner syndrome, West syndrome and Williams Syndrome, visual disorders may include reduced visual acuity and contrast sensitivity, global visual perception, and difficulties with visual exploration/visual search and oculomotor scanning [3]. More specific visual disorders are also due to neurodevelopmental disorders of genetic origin, for example, congenital or developmental visual prosopagnosia (difficulties to learn and recognize familiar faces) and dyslexia (difficulties with decoding of forms into letters, integrating letters into words, and understanding written language) [19].

Because of the often-difficult detection of morphological abnormalities in the brain, especially in cases of diffuse brain damage (e.g., in hypoxia) and in genetic disorders of brain development, Boot et al. [17] have rightly argued in favour of a functional rather than an anatomical approach to address CVI, which is focused on perceptual visual functions.

**V(visual):** Visual perception consists of various components that can also be affected individually or in combination in the case of CVI [3,20,21]. Table 1 contains a list of these components and indicates which are typically affected in CVI. In cases with suspected CVI, but without reliable empirical evidence (e.g., by brain imaging), the exclusion of disease or injury of the peripheral visual system, in particular refractive errors, retinal disease, optic atrophy, and oculomotor dysfunction (e.g., vergence, accommodation and fixation insufficiency) and of cognitive difficulties that can explain the individual visual problems sufficiently well, is of particular diagnostic importance. However, children with CVI often also have peripheral visual impairment (e.g. [6]), which in itself can impair visual perception similar to CVI or can increase CVI. Visual perception also requires cognitive foundations, in particular attention resources for the detection (alertness) and selection of visual stimuli (selective attention), the allocation of attention to several visual stimuli or parts of scenes (spatial attention) and the maintenance of perceptual activity over a longer period of time (sustained attention). The diagnostic challenge is further increased because children with peripheral vision problems can also show cognitive abnormalities [6,22]. However, cognitive limitations, e.g., in the domains of attention and (working) memory, typically show up in all visual and mostly non-visual (e.g., auditory) tasks. Consequently, the visual profile hardly shows any specific abnormalities, apart from the respective difficulty of the task. Therefore, specific or even selective visual abnormalities, which are not adequately explained by peripheral visual functional impairments or cognitive difficulties, are an indication of a CVI that is more likely to be present.

**Table 1:** Visual functions/abilities, which can be affected in CVI (depending on aetiology; modified after Boot et al., [3,17]) \*: May also be affected because of low visual acuity and/or contrast sensitivity.

Function/ability	Degree of impairment	Frequency
Visual field	mild to severe	often
Visual acuity	moderate to severe	often
Visual contrast sensitivity	moderate to severe	often
Visual adaptation	moderate to severe	often
Colour vision	mild to moderate	rarely
Movement vision	mild to moderate	rarely
Visual space perception	mild to moderate	often
Form vision*	mild to moderate	often
Object perception/recognition*	mild to moderate	rarely
Face perception/recognition*	mild to severe	rarely
Reading (text processing) *	mild to severe	often

**(Impairment):** Not every diagnosed visual dysfunction is an impairment that also adversely affects visual activities with personal impact. For example, mild forms of CVI may not be associated with impairment, unless there are additional cognitive impairments. CVI and its severity, respectively, is usually defined by reduced visual acuity and the restricted visual field; other visual

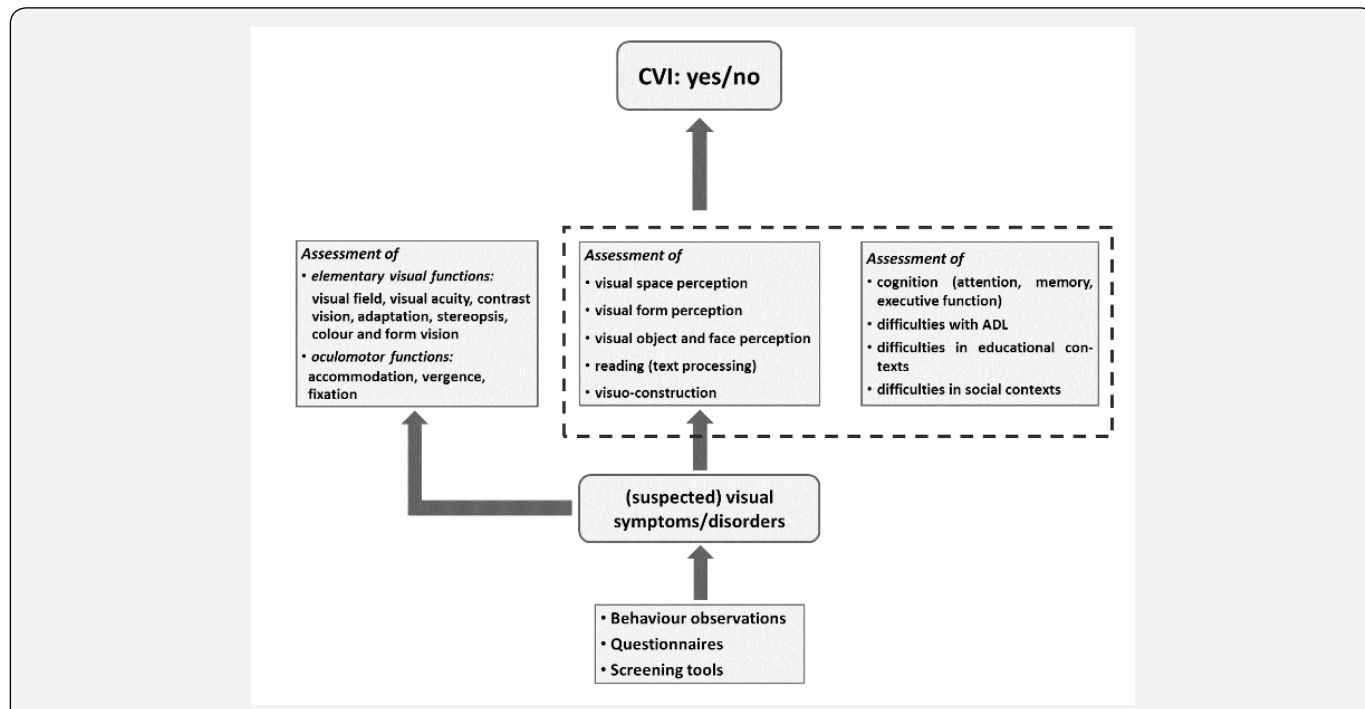
disturbances are hardly used [20]. As already mentioned above, in the case of CVI, visual acuity or visual field is not always affected; in contrast, CVI is characterized by more complex disorders of visual perception. Table 2 summarizes visual perceptual disorders most common in CVI and their effects on visual activities.

**Table 2:** Visual perceptual disorders most common in CVI and their effects on visual activities (modified after [3]).

Visual disorder	Behavioural consequences
Homonymous visual field loss	global perception of scenes and words; visual spatial orientation/navigation
Visual acuity	discrimination of fine form details; face, letter and symbol identification/recognition
Visual contrast sensitivity	detection and discrimination of shades; identification/recognition of forms, faces, letters, and symbols
Visual adaptation	adaptation to changing light conditions (e.g., photophobia)
Colour vision	discrimination of fine colour hues
Movement vision	detection of moving stimuli; speed discrimination
Visual space perception	discrimination/identification of spatial parameters (position, length, size, orientation, direction); visual spatial orientation/navigation; visuo-constructive abilities
Form vision	discrimination, identification/recognition of forms; figure-ground discrimination
Object perception/recognition	identification/recognition of (familiar) objects
Face perception/recognition	identification/recognition of (familiar) faces
Reading (text processing)	discrimination/identification of letters; global text processing

The method of systematic behavior observation is particularly suitable for the empirical recording of the intact and affected visual activities, i.e., the quality and quantity of visual impairment. The behavioral patterns of interest are documented in different conditions (contexts) in a standardized form. This so-called analysis of conditions then allows statements about the conditions under which a particular visual impairment occurs, and which conditions intensify or mitigate the respective impairment. Var-

ious standardized questionnaires and documentation forms exist for capturing visual difficulties and abnormalities in the context of CVI, some of which are very extensive (e.g., [3,23]). However, short forms also seem suitable [24], and primary school children at-risk for CVI can be identified [25]. There is a separate standardized questionnaire for recording subjective symptoms in the case of reading difficulties [26].



**Figure 1:** Simplified scheme of the diagnostic procedure in the event of suspected CVI.

From the description of the various diagnostic aspects of CVI so far, it is clear that a comprehensive diagnostic assessment is required to obtain a valid characterization of the main features of CVI [20]. The combined consideration of visual and cognitive functions and abilities in the assessment allows a valid individual diagnostic characterization of a child with (suspected) CVI [27]. Figure 1 contains a scheme of the diagnostic procedure in the event of suspected CVI.

### Other aspects of CVI

Aside from impaired visual perception, children with CVI often also have difficulties and abnormalities in cognitive areas [2,3]. As already mentioned above, around 50% of children with CVI also have impairments in the domains of attention, memory and executive function [11-14]. Attention is seen as a crucial resource for all mental activities. Reduced attention resources and the disruption of the control of these resources (the executive component of attention) can therefore also have a negative effect on the accuracy and speed of visual perception. For example, children with developmental dyslexia may exhibit a significantly slowed visual processing speed [28]. A well-functioning visual memory is a critical requirement for the transient and long-term storage of visual information. The visual working memory is important, for example, for storing information about the actual environment, landmarks and paths, objects and faces, which are then selectively stored in long-term visual memory. The visual working memory also plays a special role for word processing and thus for reading comprehension [29]. Letters, words and parts of sentences are processed and temporarily stored in working memory and thus form the basis for understanding written language. Interestingly, visual perceptible dysfunctions are only moderately associated with performance IQ, and weakly with verbal IQ [30]. Finally, it should be noted, that there exists a rather high incidence of medically unexplained visual loss in children, which may be explained by psychological problems or psychiatric disorders [3,31].

Visual impairment can also affect a child's motivational, emotional and social development. Children with developmental disorders of the brain or early brain injury generally show more often reduced motivation (in particular visual curiosity or interest in visual activities), increased motor restlessness, increased irritability, emotional lability and curiosity/motivation [32]. However, even very preterm birth is not necessarily a risk factor for developing behavioral problems and/or psychiatric disorders [33].

The correct and reliable recognition of visual social signals (facial expressions and gestures) requires sufficient visual perception, especially with regard to visual acuity, contrast vision and stereopsis. CVI can critically restrict these requirements and children may show symptoms similar to autism [34]. However, it is important to note that children with peripheral visual impairments can also exhibit autistic symptoms, depending on the severity of the visual impairment [35].

Finally, it should be mentioned that CVI can also have negative effects on the parents concerned, especially mothers. Depending on the severity of visual impairment mothers are at increased risk of parenting stress, with greater anxiety and depression [36]. Higher parenting stress may have a lasting effect on the social and emotional development of the child and thus can negatively influence their development of successful adaptation strategies and their self-confidence. Interestingly, parents rated their child's functional vision and visual quality of life significantly lower than the affected children [37].

### Long-term developments and treatment options of children with CVI

Improvements in visual perceptual functions and abilities have been reported, but it is not clear, whether this is a real recovery of vision or a successful adaptation to the individual visual impairment [3]. For the children concerned, this distinction is probably of secondary importance; the focus is on coping well with the visually demanding everyday life activities. There is no doubt that many children learn to use their visual functions better and better from day to day and to use them successfully for the visual guidance of day to day for the successful visual guidance of their behavior and the acquisition of cultural techniques (reading, writing, drawing and copying, calculation). For this regular practice and its success, cognitive and motivational prerequisites are essential. This means that children with CVI and additional cognitive impairments or motivational problems may need a longer period of practice or will show less improvement within a certain time window. It therefore seems sensible and appropriate to promote and support the improvement of visual perception through systematic and as specific as possible methods of treatment. The use of strong stimuli in more or less artificial surroundings appears, however, counterproductive, because they are not or only to a certain degree contingent with the behavior that is important for the child. Therefore, visual training and practice procedures should be ecologically valid and adapted to the child's individual needs and task demands [38]. Examples for this approach and a review of the literature on visual rehabilitation in children with CVI and visual difficulties, including visual field loss, form and color vision, visual space perception, and visual agnosia can be found in Zihl & Dutton [3]. In some cases, there is a transfer of the improved perceptual learning from the trained visual function to others; however, such a transfer cannot always be expected (e.g., [39]).

### Implications for education

From what has been described so far, it is clear that children with CVI need special treatment and support for their development according to their resources and possibilities [40,41] and in the framework of a suitable learning design [42]. These possibilities consist not only of the child's development potential, but also of the respective environment and the special support measures

that the child receives [43], an environment suitable for individual visual perceptual development. The systematic practice of visual activities to reduce visual impairment are not limited to the child's home, but also apply to kindergarten and school. As is well known, (visual) education takes place anywhere and anytime. Aside from the positive (preserved visual functions and skills) and negative (impaired visual functions and skills) visual performance pattern, a few additional factors should be considered. Increased variability in visual performance is characteristic for children with CVI; fluctuation in (visual) performance is, therefore, not (always) due to laziness or malingering (but see [3,31]). Lack of attentional resources may underlie such fluctuations. Furthermore, one should keep in mind that impaired vision always requires a very high level of attention. Visual activities are therefore always significantly more strenuous for children with CVI than for children with normal eyesight. Additionally, lighting conditions, stimulus/background contrast, context and environmental factors (e.g., noise) may influence the (visual) behavior of a child with CVI. Visual information should be focused on a particular activity, and sufficient time should always be given to carry out and repeat the respective visual task.

## Conclusion

CVI is a collective term for cerebral disorders of visual perception in children and adolescents. There are now suitable and valid test methods to record and describe CVI with sufficient reliability. Valid assessment methods range from standardized questionnaires with and without systematic behavior observation to specific tests for the various functions and services of visual perception. The examination of children with (suspected) CVI should always include an ophthalmological and orthoptic/optometric evaluation. In addition, a neuropsychological examination of cognitive performance is important; possible psychological abnormalities should also be taken into account. The result of the required interdisciplinary investigation can then serve as the basis for the indication for a tailor-made treatment, support and advice.

In his Editorial, Ravenscroft [7] has summarized the requirements for our tasks in caring for children with CVI as follows. "Children with CVI have different behaviours depending on the type and severity of damage, and these children often need sophisticated and expert support. As such I believe it is very important that we understand and know exactly how many children with CVI there are within our service, and that we all have a shared understanding of what CVI means across international borders". There is nothing essential to add to this.

## Compliance with Ethical Standards

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

## References

- Dutton G (2003) Cognitive vision, its disorders and differential diagnosis in adults and children: knowing where and what things are. *Eye* 17: 289-304.
- Philip SS, Dutton GN (2014) Identifying and characterising cerebral visual impairment in children: a review. *Clinical and Experimental Optometry* 97(3): 196-208.
- Zihl J, Dutton GN (2015) *Cerebral Visual Impairment in Children. Visuo-perceptive and Visuo-cognitive Disorders*. Wien, Heidelberg, New York: Springer.
- Maino D (2012) Pediatric cerebral visual impairment. *Optometry and Vision Development* 43: 115-120.
- Boonstra N, Limburg H, Tijmes N, van Genderen M, Schuil J, et al. (2012) Changes in causes of low vision 1988 and 2009 in a Dutch population of children. *Acta Ophthalmologica* 90(3): 277-286.
- Nielsen LS, Skov L, Jensen H (2007) Visual functions and ocular disorders in children with developmental delay. I. Prevalence diagnoses and aetiology of visual impairment. *Acta Ophthalmologica Scandinavica* 85: 149-158.
- Ravenscroft J (2016) Where is Cerebral Visual Impairment? *British Journal of Visual Impairment* 34: 3-4.
- Fazzi E, Signorini SG, Bova SM, La Piana R, Ondei P, et al. (2007) Spectrum in visual disorders in children with cerebral visual impairment. *Journal of Child Neurology* 22(3): 294-301.
- Van Genderen M, Dekker M, Pilon F, Bals I (2012) Diagnosing cerebral visual impairment in children with good visual acuity. *Strabismus* 20(2): 78-83.
- Sakki HEA, Dale NJ, Sargent J, Perez-Roche T, Bowman R (2018) Is there consensus in defining cerebral visual impairment? A systematic review of terminology and definitions. *British Journal of Ophthalmology* 102: 424-432.
- Das M, Bennet DM, Dutton G N (2007) Visual attention as an important visual function: an outline on manifestations, diagnosis and management of impaired visual attention. *British Journal of Ophthalmology* 91(11): 1556-1560.
- Tadić V, Pring L, Dale N (2009) Attentional processes in young children with congenital visual impairment. *British Journal of Developmental Psychology* 27: 311-330.
- Martin MBC, Santos-Lozano A, Martin-Hernández J, López-Miguel A, Maldonado M, et al. (2016) Cerebral versus ocular impairment: the impact on developmental neuroplasticity. *Frontiers in Psychology* 7: 1958.
- Bathelt J, de Haan M, Salt A, Dale, N J (2018) Executive abilities in children with congenital visual impairment in mid-childhood. *Child Neuropsychology* 24(2): 184-202.
- Ospina LH (2009) Cortical Visual Impairment. *Pediatrics in Review* 30(11): e81-90.
- Merabet LB, Mayer DL, Bauer CM, Wright D, Kran BS (2017) Disentangling how the brain is "wired" in cortical/cerebral visual impairment. *Seminars in Pediatric Neurology* 24(2): 83-91.
- Boot F H, Pel JJM, van der Steen J, Evenhuis HM (2010) Cerebral Visual Impairment: which perceptual visual dysfunctions can be expected in children with brain damage? A systematic review. *Research in Developmental Disabilities* 31(6): 1149-1159.
- Bosch DGM, Boonstra FN, de Leuw N, PfunDT R, Nillesen WM, et al. (2016) Novel genetic causes for cerebral visual impairment. *European Journal of Human Genetics* 24(5): 660-665.

19. Robotham RJ, Starrfelt, R (2017) Face and word recognition can be selectively affected by brain injury or developmental disorders. *Frontiers in Psychology* 8: 1547.
20. McConnell EL, Saunders KJ, Little J-A (2020) What assessments are currently used to investigate and diagnose cerebral visual impairment (CVI) in children? A comprehensive review. *Ophthalmic & Physiological Optics* 41(2): 224-244.
21. Vanclief K, Janssens E, Petré Y, Wagemans J, Ortibus E (2020) Assessment tool for visual perceptual deficits in cerebral visual impairment: development and normative data of typically developing children. *Developmental Medicine & Child Neurology* 62(1): 111-117.
22. Dale N, Sakkalou N, O'Reilly M, Springall C, De Haan M, Salt A (2017) Functional vision and cognition in infants with congenital disorders of the peripheral visual system. *Developmental Medicine & Child Neurology* 59(7): 725-731.
23. Ortibus E, Laenen A, Verhoeven J, De Cock P, Casteels I, Schoolmesters B, Buyck A, Lagae (2011) Screening for Cerebral Visual Impairment: Value of a CVI Questionnaire. *Neuropediatrics* 42(4): 138-147.
24. Gorrie F, Goodall K, Rush R, Ravenscroft J (2019) Towards population screening for cerebral visual impairment: Validity of the five questions and the CVI questionnaire. *PLoS ONE* 14(3): e0214290.
25. Williams C, Pease A, Warnes P, Harrison S, Pilon F, Hyvarinen L, West S, Self J, Ferris J (2021) Cerebral visual impairment-related vision problems in primary school children: a cross-sectional survey. *Developmental Medicine & Child Neurology* 63(6): 683-689.
26. Raghuram A, Hunter DG, Gowrisankaran S, Waber DP (2019) Self-reported visual symptoms in children with developmental dyslexia. *Vision Research* 155: 11-16.
27. Lueck AH, Dutton GN, Chokron S (2019) Profiling children with cerebral visual impairment using multiple methods of assessment to aid in differential diagnosis. *Seminars in Paediatric Neurology* 31: 5-14.
28. Stenneken P, Egetemeir J, Schulte-Körne G, Müller, HJ, Schneider FX, Finke, K (2011) Slow perceptual processing at the core of developmental dyslexia: A parameter-based assessment of visual attention. *Neuropsychologia* 49(12): 3454-3465.
29. Cain K, Oakhill J, Bryant P (2004) Children's reading comprehension ability: Concurrent prediction by working memory, verbal ability, and component skills. *Journal of Educational Psychology*, 96(1): 31-42.
30. Geldof CJ, Oosterlaan J, Vuijk PJ, de Vries JM, Kok JH, van Wassenaeer-Leemhuis AG (2014) Visual sensory and perceptive functioning in 5-year-old very preterm/very-low-birthweight children. *Developmental Medicine & Child Neurology* 56(9): 862-868.
31. Daniel MC, Coughtrey A, Heyman I, Dahlmann-Noor AH (2017) Medically unexplained visual loss in children and young people: an observational single site study of incidence and outcomes. *Eye* 31(7): 1068-1073.
32. Janssens A, Uvin K, Van Impe H, Laroche SMF, Van Reempts P, Deboutte D (2009) Psychopathology among preterm infants using the diagnostic classification zero to three. *Acta Paediatrica* 98(12): 1988-1993.
33. Linsell L, Malouf M, Johnson S, Morris J, Kurinczuk JJ, Marlow N (2016) Prognostic factors for behavioral and psychiatric disorders in children born very preterm or very low birth weight: A systematic review. *Journal of Developmental & Behavioral Pediatrics* 37(1): 88-102.
34. Chokron S, Kovarski K, Zalla T, Dutton GN (2020) The inter-relationships between cerebral visual impairment, autism and intellectual disability. *Neuroscience & Neurobehavioral Reviews* 114: 201-210.
35. Fazzi E, Serena Micheletti S, Galli J, Rossi A, Gitti F, Molinaro A (2019) Autism in Children with Cerebral and Peripheral Visual Impairment: Fact or Artifact? *Seminars in Pediatric Neurology* 31: 57-67.
36. Sakkalou E, Sakki H, O'Reilly MA, Salt AT, Dale NJ (2018) Parenting stress, anxiety, and depression in mothers with visually impaired infants: a cross-sectional and longitudinal cohort analysis. *Developmental Medicine & Child Neurology* 60(3): 290-298.
37. Tadić V, Cumberland PM, Lewando-Hundt G, Rahi JS (2017) Do visually impaired children and their parents agree on the child's vision-related quality of life and functional vision? *British Journal of Ophthalmology* 101(3): 244-250.
38. Vervloed MPJ, Janssen N, Knoors H (2006) Visual rehabilitation of children with visual impairments. *Journal of Developmental and Behavioral Pediatrics* 27(6): 493-506.
39. Huurneman B, Boonstra FN, Goossens J (2020) Specificity and retention of visual perceptual learning in young children with low vision. *Scientific reports* 10: 8873.
40. McKillop E, Dutton GN (2008) Impairment of vision in children due to damage to the brain: a practical approach. *British and Irish Orthoptic Journal* 5: 8-14.
41. Swift SH, Davidson RC, Weems LJ (2008) Cortical Visual Impairment in Children: Presentation, Intervention, and Prognosis in Educational Settings. *Teaching Exceptional Children Plus* 4(5): 14.
42. Frolli A, Rizzo S, Valenzano L, Lombardi A, Cavallaro A, Ricci (2020) Universal design for learning and intellectual disabilities. *Global Journal of Intellectual & Developmental Disabilities* 6(5): 80-84.
43. McKillop E, Bennett D, McDaid G, Holland B, Smith G, Spowart K, Dutton G (2006) Problems experienced by children with cognitive visual dysfunction due to cerebral visual impairment – and the approaches which parents have adopted to deal with these problems. *British Journal of Visual Impairment* 24(3): 121-127.



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