PACTWA, Filip, ŚLUSARCZYK, Daniel, ŻMUDA, Bartłomiej, JAKUBOWSKA, Wiktoria, PISERA, Piotr, KIEŁKOWICZ, Aleksandra, ŻUBEREK, Michał and POPIŃSKA, Zuzanna. Ophthalmic examination in children – comprehensive literature review. Journal of Education, Health and Sport. 2023;49(1):124-138. eISSN 2391-8306. https://dx.doi.org/10.12775/JEHS.2023.49.01.008
https://apcz.umk.pl/JEHS/article/view/47546
https://zenodo.org/records/10441495

The journal has had 40 points in Ministry of Education and Science of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of 03.11.2023 No. 32318. Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Health Sciences (Field of medical and health sciences); Medical sciences (Field of medical and health sciences); Cultural and religious studies (Field of humanities); Physical culture sciences (Field of medical and health sciences); Socio-economic geography and spatial management (Field of social sciences); Pedagogy (Field of social sciences); Earth and Environmental Sciences (Field of exact and natural sciences).
Punkty Ministerialne z 2019 - aktualny rok 40 punktów. Załącznik do komunikatu Ministra Edukacji i Nauki z dnia 03.11.2023 Lp. 32318. Posiada Unikatowy Identyfikator Czasopisma: 201159. Przypisane dyscypliny naukowe: Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki medyczne (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o kulturze i religii (Dziedzina nauk humanistycznych); Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Geografia społeczno-ekonomiczna i gospodarka przestrzenna (Dziedzina nauk społecznych); Pedagogika (Dziedzina nauk społecznych); Nauki o Ziemi i środowisku (Dziedzina nauk ścisłych i przyrodniczych).

The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 18.12.2023. Revised: 26.12.2023. Accepted: 27.12.2023. Published: 30.12.2023.

Ophthalmic examination in children – comprehensive literature review

Filip Pactwa, Faculty of Medicine, Medical University of Lodz, Tadeusza Kościuszki 4, 90-419 Łódź, Poland
https://orcid.org/0000-0002-9559-5072
filip.pactwa@onet.pl

Daniel Ślusarczyk, Military Medical Academy Memorial Teaching Hospital – Central Veterans' Hospital, Stefana Żeromskiego 113, 90-549 Łódź, Poland
https://orcid.org/0009-0000-3338-976X
dslusarczyk98@gmail.com

Bartłomiej Żmuda, Norbert Barlicki Memorial Teaching Hospital No.1 of the Medical University of Lodz, Stefana Kopcińskiego 22, 90-153 Łódź, Poland
https://orcid.org/0009-0005-6290-0455
zmudabartek98@gmail.com

Wiktoria Jakubowska, Faculty of Medicine, Medical University of Lodz, Tadeusza Kościuszki 4, 90-419 Łódź, Poland
https://orcid.org/0009-0008-9290-503X
wiktoria.jakubowska@stud.umed.lodz.pl

Piotr Pisera, Faculty of Medicine, Medical University of Lodz, Tadeusza Kościuszki 4, 90-419 Łódź, Poland
https://orcid.org/0009-0002-7086-7307
ptrpsr5@gmail.com

Aleksandra Kiełkowicz, Central Clinical Hospital of Medical University of Lodz, Pomorska 251, 92-213 Łódź, Poland
https://orcid.org/0009-0003-7837-0925
aleksandra.kielkowicz@gmail.com

Michał Żuberek, Faculty of Medicine, Nicolaus Copernicus University in Torun, Collegium Medicum in Bydgoszcz, Jagiellońska 13, 85-067 Bydgoszcz, Poland
https://orcid.org/0009-0008-2358-6784
zuberekmichal99@gmail.com

Zuzanna Popińska, Faculty of Medicine, Comenius University Bratislava Špitálska 24, 813-72 Bratislava, Slovakia
https://orcid.org/0000-0002-8224-6770
zuzpopinska@gmail.com

Corresponding author: Filip Pactwa, Faculty of Medicine, Medical University of Lodz, Tadeusza Kościuszki 4, 90-419 Łódź, Poland
https://orcid.org/0000-0002-9559-5072
filip.pactwa@onet.pl

Abstract

The proper functioning of the patient in the environment is made possible by the interaction of individual systems or single organs. The visual system is undoubtedly one of the most important; it is the one that enables us to find our way and acquire a range of skills to survive in the environment. Unfortunately, if neglected at a young age, complications may remain for the rest of life. A number of tests have now been introduced to check the development and

efficiency of a child's eyesight; their cyclical repetition and appropriate identification of changes or lack of them enable an appropriate diagnosis to be made and treatment to be applied, thanks to which we can eliminate or reduce the defect and, more importantly, prevent the development of a new one.

Contrary to appearances, vision screening in children does not take place in a single medical visit, it is an ongoing process, and the activities included in the screening should be carried out at each follow-up visit. This allows the practitioner to detect risk factors and eye abnormalities early on, which increases the chance of a positive outcome for the patient. It also enables the specialist to identify children who require more frequent eye checks, or patients who should be referred to a specialist qualified in children's eye examination.

During the screening examination, the doctor begins by talking to the child and parent about conditions that run in the family. The aim is to detect and identify risk factors that need to be carefully analysed. These factors include, but are not limited to, premature birth, Down's syndrome, cerebral palsy, a family history of strabismus, visual impairment, retinoblastoma, childhood glaucoma, childhood cataract or eye disease and genetic systemic diseases.

Keywords: Ophthalmology; Newborn; Retinal Diseases

Introduction

The proper functioning of the human visual system is a very important aspect with a colloquial impact on life. The visual system in the child is one of the main conditions for the development of his or her cognitive as well as educational functions. Through making eye contact, the youngster learns about human communication, while through observation of individual situations it is possible to perceive stimuli that shape his or her future behaviour. All the aspects mentioned above support the importance of an early eye examination for the child. The American Optometric Association (AOA) recommends periodic eye examinations

for children at the age of six months, then three years and before they go to school, then every two years. A child's visual system differs from that of an adult. The eyeball records the fastest growth at the age of four to six months, then slows down growing until the age of two years. A very important aspect of the ophthalmological examination of children is also the detection of retinopathy of prematurity and other eye diseases in children born prematurely. Retinopathy of prematurity is a proliferative disorder in children born prematurely, during which pathological processes occur in the immature retina. This can result in the development of tractional retinal detachment and consequent blindness. In developed countries, retinopathy is the leading cause of visual impairment in children under 5 years of age.[1,2]

Objective

To make parents of young patients, especially premature babies, aware of how important a regular eye examination is as part of caring for their child's health.

Materials and methods

In order to find the relevant literature included in this article, an electronic search of PubMed database was performed. This review included studies published in English language, with an English language abstract.

To create the publication, data were collected from 47 scientific articles, both Polish and English-language. After analysing the content contained in them, 27 articles were rejected, and the information used in the publication entitled: "Ophthalmic examination in children" originated from 20 researches.

Preparing the child for the eye examination

In the examination of the eyes of a young patient, as in the case of an adult, the history plays an extremely important role. It is accepted in the medical community that a properly conducted interview is as much as 70% of the success in making an appropriate diagnosis. During the interview, the parents answer a series of questions concerning, among other things: the purpose of the visit to the ophthalmologist, existing symptoms indicating a relevant disease entity, history of correction or previous eye surgery and regularity of previous eye

examinations, general well-being and health of the child, as well as defects or eye diseases occurring in the family. The answer to the last question is extremely important, as eye diseases affecting parents are not uncommon in children as well. The best example of this is strabismus: the probability of a child not suffering from strabismus is only 1 %, but if one parent has the condition, the probability increases to 10-20 %, and if both parents have strabismus, the probability increases to 20-30 %. [4]

History

A very important aspect of any diagnosis is history. With children it may be more complicated and he person responsible for this part of the examination is most often the legal guardian or the person that spends the most time with the young patient. Most valuable parts of the history are:

-Antenatal history to exclude TORCH infection (rash, fever, etc.)

-Perinatal history, including details of delivery, prematurity, birth weight, crying at birth, and institutional care (NICU stay).

-Systemic history, including developmental milestones, history of seizures, neuropsychological symptoms, history of cerebral palsy, and Down syndrome

-Ophthalmic history, including history of eye misalignment, eye rubbing, tearing, photophobia, white eye reflex, or other ocular complaints

-Family history, including family history and history of eye disease in parents or siblings

-Other history, including history of allergies, medication use, immunization status and previous consultations. [5]

Corneal light reflex

The corneal light reflex test involves drawing the child's attention to a target, that is, a light source or object of bright colour. During the test, a different light source is constantly directed at the child's eyes. The light reflection should be symmetrical

In both pupils of children aged between four and six months. We can encounter the phenomenon of pseudo-obesity, i.e. the wide nasal dorsum or supraorbital folds can give the impression that the eyes are deviated, but on closer inspection we see that the reflection of light is symmetrical. [6]

Visual acuity

One of the first things the ophthalmologist does during the eye examination is to measure visual acuity. With regard to younger patients, in addition to the visual acuity assessment itself, the doctor also assesses the child's behaviour. The use of ophthalmoscope charts is recommended for performing the examination in patients under the age of three according to the new recommendations of the American Academy of Ophthalmology. Currently in use are picture boards (Lea or Allen), matching boards (HOTV) find their application in illiterate children and letter boards (Snellen). When performing visual acuity testing with the boards, each eye should be tested separately. The doctor instructs the patient to cover the unaided eye when reading pictures/letters/numbers from the board. Current visual acuity standards for patients aged two and a half to six years were provided by the Multi-Ethnic Pediatric Eye Disease Study. When examining children's vision, it is important to remember that most children before the age of six do not see exactly the same in both eyes. This difference should decrease with age. For this reason, it is advisable to refer children aged five years and older for further testing only when their monocular vision scores are worse than three out of five optotypes (letters, numbers, symbols) on the 20/30 line or two lines of difference between the eyes. Once such a result is obtained, the diagnose should be directed towards amblyopia, i.e. deterioration of vision in one eye compared to both eyes. [6,13]

Pupil reaction

The pupillary examination should be performed with bright light; with this and the ability of the examiner, it is possible to assess each pupil for a direct and concordant response. The accommodative response of the eyes should also be checked, that is, the reaction of the pupils by means of the activity of the cortical centres. This manifests as pupillary constriction when closely observing approaching objects. In addition to the aforementioned activities, the pupils are also measured for size and symmetry, and the examination should be performed in both

light and darkness. A pathology in which the difference in pupil size is more than 1mm is called anisocoria. This can occur in up to 20 % of the population without any visual impairment, but can also be an indication of a visual impairment, or a disorder of the sympathetic as well as parasympathetic nervous system that requires further control. [7]

Cover tests

The covering-up, covering-up-not-covering and alternative covering-up tests are responsible for further checking alignment. During these, again the patient has one eye covered and uses the test eye.

In the covering test, the child's attention should be drawn to the target. During this activity, the other eye is covered. The movement of the test eye from a tilted position to a position that focuses on the target is diagnosed. Pathologies detected in the examination allow the detection of overt strabismus. The other eye is then uncovered and the test is repeated.

In the cover and uncover test, the cover is placed over one eye, it remains for a period of one to two seconds, during which time the child directs his or her attention to the target. At this time, the doctor removes the veil and observes the previously examined eyeball for any movement associated with the eye returning from a deviated position to fixation on the target. This makes it possible to detect covert strabismus. [8]

In the alternating covering test it is possible to detect covert strabismus. As in the test above, one eye is covered while the lid is held in place for a few seconds, then quickly moved over to the other eye and left there for a few seconds, after which the lid is returned to the eye being examined. The whole process is repeated several times. The specialist has to assess the eye for refixation, each time the cover is moved.

The tests described above should be performed on both eyeballs, both with an object a short distance away and with an object placed further away. Each test should be performed in three trials to confirm the diagnosis. If the test is negative, the patient should be referred with a strabismus duel. It is important to remember that in some children strabismus may occur sporadically, for example when the child is tired. It is also necessary to refer a child for further diagnosis when a parent reports a deviation occurring at home, even though it was not detected during the tests carried out at the surgery.[9]

Examination of the external parts of the eye

Another part of the young patient's eye screening is the examination of the external parts of the eye, which includes anatomical structures such as the eyelids, orbit, conjunctiva, sclera, cornea and iris. When performing this part of the examination, the ophthalmic specialist should use a light source to assess for abnormalities such as excessive lacrimation, hypersensitivity to light, conjunctival injection, gross structural abnormalities and watery or purulent discharge. The most common cause of persistent eye discharge in infants is obstruction of the tear duct. The defect is recognised when the eye begins to secrete mucus, caused by pressure on the lacrimal sac. Possible treatment is to massage the lacrimal duct; when there are additional symptoms, such as infections, we should use antibiotic treatment. Continuous monitoring of the pathology is also recommended, as the symptoms resemble childhood glaucoma, which requires a different treatment. The distinguishing feature of the pathologies is the redness and swelling present in glaucoma. In addition to the symptoms mentioned above, glaucoma also manifests itself with corneal opacity, hypersensitivity to light and eye enlargement. If the symptoms mentioned above occur, it is advisable to quickly refer the patient to a specialist, as untreated glaucoma can cause blindness. [10]

Fixation and alignment

We should assess visual fixations routinely at every screening examination and other visits to the ophthalmologist. Full response to the examiner's face should be demonstrated by children older than six weeks of age. At the later age of two months, the child should be able to fixate the gaze and follow the object shown by the examiner. An indication for further control and eye examination is if the child does not have the above mentioned activities at the age of three months. The doctor also has the task of assessing the alignment of the eyes, as its pathologies allow the patient to be diagnosed with strabismus. The defect can be caused by a number of factors, including abnormalities in the innervation of the eye muscles or other conditions, such as visual impairment, cataracts or retinal tumours, among others. [11]

Red reflex

The red reflex examination makes it possible to detect a number of pathologies of the visual organ, including eye alignment, asymmetric refractive errors, cataracts or retinal

abnormalities. An ophthalmoscope is used for the examination. Diagnosis should be performed in a darkened room, the ophthalmoscope should be about 30-45 cm from each eye of the patient, and then about 60-90 cm to diagnose both eyes together. A symmetrical orange-red light should reflect from both eyes, but the hue of the light may vary depending on the pigmentation of the eyes. Abnormalities detected by the examination, such as color asymmetry or the presence of dark or white spots, should argue for broadening the diagnosis and referring the patient to a specialist.). The only situation that should not cause us concern is the presence of mucus in the tear film, it is observed as a moving opacity that disappears after blinking.[12]

Visual impairment

After performing the above-mentioned steps, during the examination the doctor should also check for the possibility of amblyopia, or what is known as low vision. The defect is due to a condition affecting reduced vision in the eye, which consequently leads to the brain's incorrect perception of the image obtained in a given eyeball. The ethology of such a condition can vary widely, while factors that increase its incidence include strabismus, childhood cataracts, neurological disease, eye trauma, retinal damage or significant refractive error between the eyes. Currently, unfortunately, there is no single test to detect every case of visual impairment, there are only a few procedures at the doctor's disposal to help identify visual impairment. Such procedures include alignment screening and red reflex testing, among others. We can suspect the presence of visual impairment in very young children when the patient consistently resists covering one eye more than the other. A rare but challenging symptom that can indicate vision loss is nystagmus. It is also very common for young children to try to compensate for visual anomalies, for example, by tilting their heads.[13,14]

The examination should be pleasant for the child

As we all know, children are very quickly distracted; every little stimulus can cause an excessive stress reaction, which can manifest itself as crying, screaming and often even generalised distraction, which makes it very difficult to carry out the eye examination at an appropriate level. In order to prevent the above-mentioned situations, the ophthalmologist should try to make the visit look like fun and the young patient willingly participate. Another very important aspect is to ensure that the parents satisfy all the child's physiological needs before the eye examination. The young patient should be sleepy and full. The doctor, on the

other hand, should ensure the right atmosphere during the visit. This means that the temperature in the room should be appropriate, the lighting should not be too bright and the doctor's language should be adapted to the patient. [3]

Screening for retinopathy and other disease entities in infants born prematurely.

As already mentioned, retinopathy is the most common cause of visual impairment in children up to 5 years of age in developed countries, so a very important part of the examination is the examination of vision in premature infants for the aforementioned disease entity. According to the Regulation of the Minister of Health of 6 November 2013 on guaranteed services in the field of outpatient specialised care, Dz. U. 2013. 1413 (Journal of Laws of 2 December 2013), based on Article 31 d of the Act of 27 August 2004 on health care services financed from public funds (Journal of Laws of 2008 No. 164, item 1027, as amended), examination of the organ of vision in premature infants born before 32 weeks of age or whose body weight is between 0 - 1500g is obligatory. Situations in which the aforementioned activity is also mandatory are children born before 36 weeks of gestation, , with intrauterine growth retardation, treated with intensive oxygen therapy and phototherapy. The examination should be carried out by a doctor who is experienced in the diagnosis of neonatal eye diseases. The doctor begins the examination by dilating the pupils of the newborn. It is recommended that 2.5% phenylephrine and 0.5-1% Tropicamidum be used for this,Dilate the pupils by dropping drops 2-3 times into the child's eyes one hour before the test is performed. The patient's condition should be monitored during the administration of the drops, as they can cause bradycardia and cardiac arrhythmia. The administration of local anaesthetics is also recommended. To carry out the examination, the ophthalmologist should use: a dilator (which prevents the child from closing his/her eyelids), a magnifying glass and an indirect speculum. If retinopathy is suspected, a retractor or strabismus hook will also be needed. According to the recommendations of the American Academy of Pediatrics (AAP), the age of the infant at the time of the first eye examination depends on its maturity. The timing of the subsequent follow-up tests is determined by the ophthalmologist carrying out the first visit and depends on the clinical picture obtained. [16,17,18,19]

Tests performed in young children

Currently, doctors have access to a range of tests to diagnose the relevant eye disease entity and to control and prevent the occurrence of new defects. Among those used are :

-Vestibulo-ocular reflex involving eye movement and head rotation. The eyeballs move in the opposite direction to the rotation of the head, so that the image on the retina is not displaced.

-Optokinetic oculomotor reflex , i.e. the reflex of attempting to fixate on a moving object in the visual field and when observing a disc with alternating black and white stripes. This test is responsible for checking the developmental function of the oculomotor muscles.

- The Hirschberg test is used to objectively measure tropia. The patient observes a light source 40 to 50 cm away, during which the doctor compares the positions of the reflexes from the cornea for the right and left eye.

- Bruckner test During this test, the doctor observes and compares the reflections from the retinas for both eyes. Attention is paid to the colour, brightness and size of the glare. The test must take place in a darkened room so that the pupils are dilated so that observations can be made more easily. [20]

The progress of medicine in recent times has been almost unbelievable, so new methods of ophthalmic examination in newborns and children are becoming more and more common. A great many of these are under development, or are only used in individual countries.

Long-term follow-up - what about the patient taking the next steps

The visual organ requires constant care. Follow-up examinations should be carried out at an appropriate interval. Mostly during the patient's adolescence, if there are no contraindications and no worrying changes in the visual system, a check-up should be carried out each time during the child's balance sheet. These should take place at the ages of 2, 4 and 6 and at a later date, and it is important to ensure that the young patient attends each of these check-ups and that they are carried out by a general practitioner or paediatrician. During such an examination, the doctor replaces digital and letter optotypes, for example with images of animals. The child, seated at an appropriate distance, is asked to respond to what he or she sees on the board or to demonstrate by appropriate hand positioning. This is a simple and pleasant examination that should not cause discomfort to the child. [6]

Conclusions

The eye examination in children differs from the typical examination performed on an adult patient. The optometrist must have adequate knowledge of the visual system in younger patients. In addition, it is necessary to equip the ophthalmologist's practice with specialised equipment, i.e. the test kits and instruments used. In addition to adequate preparation of the practice and the specialist himself, an aptitude for working with children is also very useful. Qualities such as patience and the ability to communicate with the smallest patients are most desirable here.

The consequences of untreated vision loss can be very drastic. Untreated low vision in many cases even leads to permanent vision loss. The diagnostic process may not always be easy, and it is especially difficult to detect visual impairment in illiterate children. However, every effort should be made to obtain a correct diagnosis, as earlier treatment gives better results.

Author's contribution

Conceptualization, Filip Pactwa and Zuzanna Popińska; methodology, Wiktoria Jakubowska and Piotr Pisera; software, Daniel Ślusarczyk and Aleksandra Kiełkowicz; check, Filip Pactwa and Bartłomiej Żmuda; formal analysis, Zuzanna Popińska and Daniel Ślusarczyk; investigation, Bartłomiej Żmuda and Michał Żuberek; resources, Michał Żuberek and Wiktoria Jakubowska; data curation, Piotr Pisera and Filip Pactwa; writing – rough preparation, Filip Pactwa; writing - review and editing, Zuzanna Popińska; visualization, Piotr Pisera and Aleksandra Kiełkowicz; supervision, Michał Żuberek, Bartłomiej Żmuda and Wiktoria Jakubowska; project administration, Filip Pactwa.

All authors have read and agreed with the published version of the manuscript.

Funding Statement

The study did not receive special funding.

Institutional Review Board Statement

Not applicable

Informed Consent Statement

Not applicable

Acknowledgments

Not applicable

Conflict of Interest Statement

The authors report no conflict of interest.

References:

1. Sharma M, VanderVeen DK. Identification and Treatment of Retinopathy of Prematurity: Update 2017. NeoReviews 2017;18(2).

2. Jefferies AL and Canadian Paediatric Society, Fetus and Newborn Committee. Retinopathy of prematurity: An update on screening and management. Paediatr Child Health 2016;21(2):101-104.

3. Bell AL, Rodes ME, Collier Kellar L. Childhood eye examination [published correction appears in Am Fam Physician. 2014 Jan 15;89(2):76]. *Am Fam Physician*. 2013;88(4):241-248.

4. American Academy of Pediatrics Section on Ophthalmology, American Academy of Ophthalmology, American Association for Pediatric Ophthalmology and Strabismus, American Association of Certified Orthoptists. From the American Academy of Pediatrics. Screening Examination of Premature Infants for Retinopathy of Prematurity. Pediatrics 2013;131(1):189-195.

5. Saxena, Rohit; Sharma, Pradeep; Gopal, Santhan1 the Pediatric Ophthalmology Expert Group. National consensus statement regarding pediatric eye examination, refraction, and

amblyopia management. Indian Journal of Ophthalmology 68(2):p 325-332, February 2020. https://doi.org/10.4103/ijo.IJO_471_19

6. Hutchinson AK, Morse CL, Hercinovic A, Cruz OA, Sprunger DT, Repka MX, Lambert SR, Wallace DK; American Academy of Ophthalmology Preferred Practice Pattern Pediatric Ophthalmology/Strabismus Panel. Pediatric Eye Evaluations Preferred Practice Pattern. Ophthalmology. 2023 Mar;130(3):P222-P270. https://doi.org/10.1016/j.ophtha.2022.10.030

7. Lambert JE, Christiansen SP, Peeler CE. Don't Miss This! Red Flags in the Pediatric Eye Exam: Pupils. *J Binocul Vis Ocul Motil*. 2019;69(3):102-105. https://doi.org/10.1080/2576117X.2019.1609893

8. Zheng Y, Fu H, Li R, Lo W-L, Chi Z, Feng DD, Song Z, Wen D. Intelligent Evaluation of Strabismus in Videos Based on an Automated Cover Test. *Applied Sciences*. 2019; 9(4):731. https://doi.org/10.3390/app9040731

9. Mestre C, Otero C, Díaz-Doutón F, Gautier J, Pujol J. An automated and objective cover test to measure heterophoria. PLoS One. 2018 Nov 1;13(11):e0206674. https://doi.org/10.1371/journal.pone.0206674

10. Wilkie DA. The Ophthalmic Examination as It Pertains to General Ocular Toxicology: Basic and Advanced Techniques and Species-Associated Findings. Ocular Pharmacology and Toxicology. 2013 Aug 29:143–203. https://doi.org/10.1007/7653_2013_7

11. Cotter SA, Tarczy-Hornoch K, Song E, Lin J, Borchert M, Azen SP, Varma R; Multi-Ethnic Pediatric Eye Disease Study Group. Fixation preference and visual acuity testing in a population-based cohort of preschool children with amblyopia risk factors. Ophthalmology. 2009 Jan;116(1):145-53. https://doi.org/10.1016/j.ophtha.2008.08.031

12. Toli A, Perente A, Labiris G. Evaluation of the red reflex: An overview for the pediatrician. *World J Methodol*. 2021;11(5):263-277. https://doi.org/10.5662/wjm.v11.i5.263

13. Rutstein RP, Corliss DA. Long-term changes in visual acuity and refractive error in amblyopes. *Optom Vis Sci*. 2004;81(7):510-515. https://doi.org/10.1097/00006324-200407000-00012

14. Park SH. Current Management of Childhood Amblyopia. Korean J Ophthalmol. 2019 Dec;33(6):557-568. https://doi.org/10.3341/kjo.2019.0061

15 Leviton A, Dammann O, Engelke S i wsp. The clustering of disorders in infants born before the 28th week of gestation. Acta Paediatr 2010;99:1795-1800.

16. Hellström A, Smith LEH, Dammann O. Retinopathy of prematurity. Lancet 2013;382(9902):1445-1457.

17. Friddle KM, Yoder BA, Hartnett ME i wsp. Can a Risk Factor Based Approach Safely Reduce Screening for Retinopathy of Prematurity? Int J Pediatr 2017;2017:9372539.

18. Quinn GE. Challenges and Future Directions in the Detection and Treatment of Retinopathy of Prematurity. NeoReviews 2017;18(2).

19. Rivera JC, Holm M, Austeng D i wsp. Retinopathy of prematurity: inflammation, choroidal degeneration, and novel promising therapeutic strategies. J Neuroinflammation 2017;14(1).

20. Incesu AI, Sobacı G. Malingering or simulation in ophthalmology-visual acuity. Int J Ophthalmol. 2011;4(5):558-66. https://doi.org/10.3980/j.issn.2222-3959.2011.05.19.