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Screening visual tests for early school-age children

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HIGHLIGHTS

Early detection of vision problems offers hope for prompt treatment and improved functioning in adulthood. It's crucial to have children examined by an ophthalmologist at least once a year.

ABSTRACT

In young children, symptoms of eye diseases often go unnoticed. Disorders such as amblyopia, strabismus, and anisometropia can be detected during screening tests, which are crucial for early diagnosis and treatment. The most common cause of amblyopia is strabismus, but other vision defects can also cause it. High myopia, increasingly common among children, is associated with prolonged screen time. Screening tests have shown that 23.28% of children require further ophthalmological evaluation. Early examinations are crucial for proper visual development, so every child should be examined annually.

Key words: myopia, strabismus, amblyopia, preventive examinations, pediatric ophthalmology

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INTRODUCTION

In young children, the symptoms of many eye diseases may go unnoticed. Unlike adults, young children with unilateral and often also significant bilateral visual impairment rarely complain of discomfort or report poor vision. However, these types of disorders can be detected through screening, and early detection is crucial for prognosis. The main goal of vision screening in early school-age children is to detect amblyopia and related eye disorders, such as strabismus and anisometropia [1].
Amblyopia is a visual impairment that develops as a result of insufficient visual stimulation of one or both eyes during the development of the visual process. Although strabismus is the most common cause of amblyopia, other serious eye diseases can also affect the normal development of vision, leading to amblyopia. Although amblyopia is an eye disease, it develops in the visual centres of the cerebral cortex. Untreated amblyopia leads to permanent visual impairment over time, so the earlier a child with amblyopia receives vision therapy from an orthoptist, the greater the chance of reducing amblyopia to a minimum. Amblyopia can be detected by testing visual acuity or by using objective tests designed to assess risk factors for amblyopia, which include anisometropia (different refractive errors in each eye), high refractive errors and strabismus [2–4].
Strabismus is a misalignment of the eyes: the visual axes of both eyes are not directed in the same direction at the same time. Strabismus is classified based on the direction of the eye deviation. On this basis, the following types are distinguished: convergent strabismus (esotropia), divergent strabismus (exotropia) and upward strabismus (hypertropia). Discrete strabismus is often diagnosed later than its more obvious cases, which is why the angle of deviation in strabismus is inversely proportional to the degree of visual impairment. The diagnosis of strabismus involves, for example, the cover test, the corneal reflex test and the Brückner test [4, 5].
It has been shown that 2–6% of children under the age of 7 have amblyopia (the most common cause of reduced visual acuity in children), while 2–4% have strabismus, which can lead to amblyopia [6]. Amblyopia affects the quality of life and limits career opportunities [7]. Treatment of amblyopia is very effective if the defect is detected early. Unfortunately, the time for effective intervention ends before the start of school, and it is only during the school years that screening tests are carried out. Therefore, it is necessary to conduct tests on younger children. Every child should have their eyesight tested once a year.
Severe cases of hidden and uncorrected hyperopia can cause headaches. Vision defects may be accompanied by various non-specific complaints or symptoms, such as itchy eyes and rubbing, redness, rolling or closing of the eye, all kinds of tics and squinting. The child may also complain of fatigue during close-up visual activities [8].
High myopia already affects 40% of children in Europe and North America and 60% in Asia. This percentage is constantly growing due to changes in civilisation. An increasingly common cause of myopia is spending long periods of time in front of computer screens, tablets and phones, and too little time outdoors (in daylight). Additional risk factors for myopia include: using LED lamps for homework, insufficient sleep, reading at less than 25 cm, and living in an urban environment. If myopia appears before the age of 9, there is a high risk that the defect will quickly increase and may reach a level of high myopia (above -6.00 D) in adulthood. High myopia significantly increases the risk of serious complications later in life, such as glaucoma, retinal detachment, and myopic maculopathy. If myopia is detected early, treatment methods can be introduced to slow its progression [9].
A visual field test (cover test) is used to assess the position of the eyeballs and diagnose strabismus. It involves alternately covering both eyes and observing the subsequent movements of the uncovered eye. The occurrence of such adjusting movements may indicate the presence of strabismus. No instruments are needed to perform the alternating eye occlusion test, which can be used to diagnose strabismus. The observer simply watches to see if the uncovered eye makes an adjustment movement to fixate. If no movement occurs, the eyeballs are aligned parallel to each other [10].
Photoscreening (automatic refractometry, analysis of photos taken with a special camera or video camera) is used to assess refractive errors, opacities in the optical media, and the alignment of the eyeballs in a single axis. An autorefractometer directly measures refractive errors in each eye. Portable, handheld autorefractors, such as the Welch Allyn VS-100S, are helpful in detecting high refractive errors and anisometropia (difference in refractive power between the eyes), which are risk factors for amblyopia. Over the past few years, the equipment used in photoscreening and automatic refractometry has been improved, so that reliable measurements of parameters assessing disorders causing amblyopia can now be obtained quickly. The advantage of these devices is that they allow for objective testing with minimal cooperation from the patient [11].
In young children, photoscreening is the most effective method of vision screening. The effectiveness of this method has been scientifically confirmed in numerous studies [12]. It has been proven that in children aged 3–4 years, photoscreening reduces the time needed for the examination and achieves more reliable results than traditional methods of vision testing [13, 14].
The photoscreening device (portable paediatric autorefractometer) is the size of a camera, and the examina-

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tion is more like taking a photo than a traditional visit to an ophthalmologist. The test is completely non-contact and non-invasive. The child only needs to look at the device held by the examiner at 1 m for a few seconds. An audible signal makes the test more attractive, so that children are happy to participate [15].

PROJECT DESCRIPTION

Between April and June 2024, a team of ophthalmologists led by prof. Dariusz Dobrowolski, MD, PhD, conducted screening tests for the early detection of factors contributing to visual impairment and vision defects in children. The screening covered children aged 6–9 (grades I–III) attending Primary School No. 67 in Katowice. A total of 189 children were examined.

The children's parents were informed in advance about the possibility of having their children examined free of charge at school. Children whose parents did not consent to their participation in the study were not eligible for the examination. Parents received written information about how the examination would be conducted and, after the examination, written information about their children's eye health and, if abnormalities were found, about the need for further examination at a specialist centre.

The examinations were performed using, among other things, a portable device for photoscreening – the Welch Allyn VS-100S paediatric autorefractometer.

The Bioethics Committee of the Medical University of Silesia in Katowice gave its consent for the examinations to be carried out.

TEST PROCEDURE

The first part of the test was to check visual acuity on Snellen charts from 5 m, both without correction and with the best possible correction. Next, the position of the eyeballs was checked in the cover test (alternate eye covering test). This test showed whether the eyes were aligned correctly or whether there was divergent or convergent strabismus, either latent or manifest. Next, convergence was tested, i.e. the ability to focus on an object that was approaching the patient's nose from about 50 cm. If the patient's eyes converged when the object was brought close to the nose, this indicated normal convergence. However, if the eyes were unable to keep up with the object, this indicated weakened or absent convergence. The Ishihara test, which assesses the ability to recognise colours, was also performed. One of the most important stages of the examination was the photoscreening test, i.e. an examination with a Welch Allyn VS-100S portable paediatric autorefractometer. The test consisted of taking a 'picture' of the child's eyes from 1 m. The test result indicated the spherical and cylindrical defect and the cylinder axis. The test was completely painless.

RESULTS

A total of 189 children were included in the study, including 97 girls and 92 boys. The mean uncorrected visual acuity was 0.9. The median visual acuity was 1.0, standard deviation 0.2. These statistics were identical for the left and right eyes separately.

In the convergence test, 6.88% of children (13 children) showed convergence weakness. The cover test analysis showed divergent strabismus in 21.16% of cases (40 children) and convergent strabismus in 3.17% of cases (6 children). The colour vision test using Ishihara plates showed abnormal colour recognition in 4.23% of cases (8 children). Table 1 shows the results of the spherical equivalent analysis (spherical equivalent = sphere + ½ cylinder) for each eye separately (tab. 1).

TABLE 1

Results of the spherical equivalent analysis.

Spherical equivalent value	Right eye	Left eye
0 (normal vision)	33 (17.46%)	35 (18.52%)
<0 (myopia)	35 (18.52%)	42 (22.22%)
>0 (hyperopia)	121 (64.02%)	112 (59.26%)

After a complete analysis of the tests of all children, it was shown that in 23.28% of cases (44 children) in-depth ophthalmological and orthoptic diagnostics at a specialist centre is recommended.

CONCLUSIONS

By performing eye screening tests early enough, doctors play a key role in preserving normal vision in children. Symptoms of strabismus, anisometropia and amblyopia are not always obvious to parents. These disorders are the focus of eye screening tests in children. Children with abnormal results should be referred for a comprehensive eye examination. Early detection and treatment are essential for maintaining excellent vision in every child.

Good vision is necessary for the proper development of a child. Undiagnosed and uncorrected vision defects cause concentration problems and headaches, and consequently poorer academic performance. A child will not tell us that they have poor vision because if the defect appeared in early childhood, they are unable to notice the deterioration in relation to normal vision.

In summary, the symptoms of vision defects may be related to the eyes, but they may also be hidden. We must also

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remember that approximately 20–30% of vision defects are completely hidden [1, 16], i.e. they do not yet cause any symptoms or discomfort. That is why it is so important to perform routine eye examinations in children, even those who do not report any problems or discomfort. It is recommended that children undergo an annual examination (after accommodation paralysis) by a paediatric ophthalmologist. This is confirmed by our study, which showed that almost a quarter (23.28%) of the children participating in the study after undergoing tests.

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Edward Wylęgała – approval of the final version sent to print.

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