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NEED FOR REFRACTIVE ERRORS SCREENING IN SCHOOL-AGE CHILDREN BY OBJECTIVE METHODS

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ABSTRACT. We emphasize the importance of a correct vision in school-age children. Vision screening is not enough. We propose as a method for determining the exact refraction: computerized photoretinoscopy. *Methods:* We examined 1121 students, aged 6 to 11 years from 5 primary schools in Arad County, in September 2011 March 2012. My attention was focused on the following parameters: age, gender, objective refraction, visual acuity. Refraction was measured with an autorefractometru Potek 5000. Visual acuity was assessed by Snellen test. Its values less than or equal to 0.8 (80%) are considered pathological. Were considered pathological values as follows: myopia - minimum-1.0DS refractive error (spherical diopters), hyperopia refractive error of +1.5 SD, and 1.0 DC astigmatism (cylindrical diopters). *Results:* Of the 1121 students enrolled in our study 315 had refractive errors, 48 myopia, hyperopia 159 and 108 astigmatism. Using as reference the visual acuity of 4/5 (80%) we found 275 cases with vision problems. Using computerized refractometer we found 315 cases of children with refractive errors. *Conclusion:* Getting in the screening results of visual acuity of above 0.8 indicates no emmetrop eye status. Hypermetropia, astigmatism and myopia may even be sources of ocular discomfort. To identify these refractive errors computerized testing is required under cycloplegic refractometry.

Keywords: visual acuity, schoolchildren, screening

INTRODUCTION

The importance of normal vision in children worldwide was launched in visual acuity screening programs financed with government funds. Amblyopia is one of the most common defects of view diagnosed in children, and also a key target for screening programs. (European Journal of Scientific Research,ISSN (2009), Marsh-Tootle WL. et al., 2008)

Visual disturbance due to refractive errors is one of the most common diseases of the students and the second leading cause of blindness worldwide that could be treated (Budău M. et al., 2003). Most students with uncorrected refractive errors are asymptomatic, eye screening therefore helps early detection and treatment of this disorders. We want to show that only vision screening is not sufficient to establish the ocular functional status. This should be complemented by computerized refractometry under cycloplegic and coverage - discoverage test. In countries like Romania with a greater presence of children in schools is recommended the introduction of routine visual screening. (World Health Organization. Elimination of avoidable visual disability due to refractive error. 2000) However, it is not considered the addressability in the ophthalmic services and the magnitude of refractive errors in the two areas, urban and rural. (Jompan A., 2000)

Amblyopia is also one of the most common causes in appearance of the unilateral defects in older people. (Lim HT. et al., 2004, Newman DK, et al., 1999)

After amblyopia, strabismus is the second most important defect to be introduced in the screening programs. (Donahue SP. et al., 2003)

Objective and subjective tests are performed to detect these two conditions in children from kindergarten and primary school: visual acuity testing table E, and subjective tests such as the coverage test are the most common screening tests for visual acuity. (Evans J. et al., 2009, Preslan MW. et al., 1998)

A review of the literature indicates that these tests are of different sensitivity and specificity. (Marsh-Tootle WL. et al., 2008, Ehrlich MI. et al., 1983, Spierer A. et al., 1999, Chui L. et al., 2004)

Specific data are needed regarding the prevalence and distribution of refractive errors obtained through population surveys to plan cost-effective program to reduce, prevent and treat visual disorders among school and preschool children. It is therefore expected that refractive errors, which represent some of the most common causes of visual impairment in children, to be tested in all screening programs. However, there are reports that in some countries, screening is done still in its traditional form by Snellen charts and alignment tests.

The purpose of this report is to demonstrate and highlight the need to include objective tests to measure refractive errors in vision screenings.

MATERIALS AND METHODS

This study is part of a larger project. Parts of it have already been communicated as scientific papers in various journals (Cunningham F. 1959, Turcin L. et al., 2012).

This study was conducted between September 2011 and March 2012. We obtained verbal consent of the director of the teachers and parents of children who would be placed in the study. Research protocol

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complies with the Declaration of Helsinki on research involving human beings.

Target batch size was calculated with Kish and Leslie formula for an expected prevalence of 30% with an error of 5% at a confidence level of 99%.

We examined 1121 children aged between 6 and 11 years enrolled in 5 primary schools in Arad (urban) and children from 5 schools in from communes of Arad County (rural). Children examined show no acute ophthalmologic pathology that may influence visual acuity or refraction. My attention was drawn to the following parameters: age, sex, objective refraction under cycloplegy, visual acuity. The exclusion criteria were rated children who refused to be examined by various subjective reasons even if I got the parent's accept.

Distance vision of students was tested using Snellen table or the illiterate "E" table. Visual acuity was tested at 6m. If visual acuity without correction was less than or equal to 0.8 regardless of the eye (or only in one eye or in both), the subject was considered as having visual disturbances.

Test coverage - discovery was conducted to confirm or deny the presence of trophies or phories. If the examined eye moves after the removal of the covering we confirm the presence of a phorie . If the deviation angle does not change the test coverage - discovery is considered that the patient has a trophee (more than 5 degrees / 10 prism diopters). Eye movements were tested in all 6 cardinal directions to exclude paralytic or restrictive strabismus. Anterior segment was examined with an ophthalmologic flashlight to detect cataract, anophthalmia, microphthalmia, megalocornea or previous ocular surgery. Objective refraction was measured with a autorefractometer Potek 5000, under a previous cycloplegiy applied to the subjects, obtained with instillation of cyclopentolate 1% solution applied at 15 minute intervals for one hour. This procedure was applied to all children regardless of the visual acuity found.

Statistical analysis was obtained with Epi Info 7.

Emmetropia is defined as spherical equivalent between -1.00 and +1.00. It is considered myopia the objective refraction greater or equal to -1.00 SD at one or both eyes. Hyperopia was defined as objective refraction measured greater than or equal to +1.50 DS in one or both eyes. Astigmatism was considered to values greater than or equal to 1.00 D. The results are presented in tables and charts.

All children with uncorrected refractive errors were given the opportunity to purchase discounted glasses. Children with eye pathology were followed and examined further in the clinic pro bono.

The findings were shared with the scientific community and policy have been proposed to improve eye health services.

RESULTS AND DICUSSIONS

We examined 1121 students both in rural and in urban areas. Thus, 612 children from rural and 509 urban children.

In rural areas we found 28 students nearsighted with visual acuity less than or equal to 0.8 and 3 students nearsighted with visual acuity better than 0.8. Regarding hyperopia 54 students had a visual acuity less than or equal to 0.8 and 11 students a visual acuity greater than 0.8. If astigmatism 77 students had a visual acuity less than or equal to 0.8 and 12 students a visual acuity greater than 0.8. If we refer to all studied refractive errors we see that 159 students had a visual acuity less than or equal to 0.8 and 26 students a visual acuity greater than 0.8. In total we found 31 students with myopia, hyperopia 65 students and 89 students with astigmatism. In rural areas of the 612 students examined, 185 students had refractive errors upon examination. (Table 1.A)

In rural vision screening using visual acuity of 0.8 in the case of myopia has a sensitivity of 90.32% and a specificity of 99.3%, in the case of hypermetropia a sensitivity of 83.08% and a specificity of 97.42%; regarding astigmatism a sensitivity of 86.52% and a specificity of 96.72%. If we refer to all refractive errors we obtained a sensitivity of 85.95% and a specificity of 93.44%. (Table 1.C)

In rural areas we found 16 myopic students with visual acuity less than or equal to 0.8 and a student nearsighted with acuity better than 0.8 visual. Regarding hypermetropia 38 students had a visual acuity less than or equal to 0.8 and 5 students a visual acuity greater than 0.8. Regarding astigmatism 62 students had a visual acuity less than or equal to 0.8 and 8 students had a visual acuity greater than 0.8. If we refer to all studied refractive errors we observe that 116 students had a visual acuity less than or equal to 0.8 and 14 students a visual acuity greater than 0.8. In total we found 17 students with myopia, 43 students and 70 students hyperopia with astigmatism. In urban areas of the 509 students examined, 130 students had refractive errors upon examination. (Table 1.B)

In the urban area the vision screening using visual acuity of 0.8 for myopia has a sensitivity of 94.12% and a specificity of 99.47%, in case of hypermetropia a sensitivity of 88.37% and a specificity of 98.42%, in case of astigmatism a sensitivity of 88.37% and a specificity of 97.36%. Reporting our results to all refractive errors I got 89.23% sensitivity and a specificity of 95.25%. (Table 1.D).

TABLE 1.

A)

Rural

AV*decimal	M*	H*	A*	Refractive errors
0.1	3	4	5	12
0.2	4	6	11	21
0.3	5	7	9	21
0.4	4	8	8	20
0.5	5	11	12	28
0.6	2	5	13	20
0.7	3	8	10	21
0.8	**2**	**5**	**9**	16
0.9	2	5	7	14
1	1	6	5	12
	31	65	89	185

B)

Urban

AV*decimal	M*	H*	A*	Refractive errors
0.1	2	4	8	14
0.2	1	5	7	13
0.3	2	7	10	19
0.4	2	7	9	18
0.5	2	6	7	15
0.6	4	3	9	16
0.7	2	2	6	10
0.8	**1**	**4**	**6**	11
0.9	0	3	4	7
1	1	2	4	7
	17	43	70	130

C)

Rural	M*	H*	A*	Refractive errors
Sensibility (%)	90.32	83.08	86.52	85.95
Specificity (%)	99.3	97.42	96.72	93.44

D)

Urban	M*	H*	A*	Refractive errors
Sensibility (%)	94.12	88.37	88.57	89.23
Specificity (%)	99.47	98.42	97.36	95.25

AV =visual acuity, M = myopia, H = hipermetropia, A = astigmatism

Compared to all children aged 6 to 11 years included in the study we found 44 myopic students with visual acuity less than or equal to 0.8 and 4 students nearsighted with visual acuity better than 0.8. Regarding hypermrtropia 92 students had a visual acuity less than or equal to 0.8 and 16 students a visual acuity greater visual acuity than 0.8. In case of astigmatism 139 students had a visual acuity less than or equal to 0.8 and 20 pupils with a greater visual acuity than 0.8. Compared to all refractive errors studied we can observe that 275 students had a visual acuity less than or equal to 0.8 and 30 students had a visual acuity greater than 0.8. In total we found 48 students with myopia, hypermetropia 108 students and 159 students with astigmatism. Of the 1121 students screened, 315 students had refractive errors at the time of examination. (Table 2.A)

Compared to all children aged 6 to 11 years included in the study, vision screening using visual acuity of 0.8, shows, in case of myopia a sensitivity of 91.67% and a specificity of 99.38% in hypermetropia a sensitivity of 85.19% and a specificity of 97.89%, in case of astigmatism a sensitivity of 97.42% and a specificity of 97.02%. Compared to all refractive errors we obtained a sensitivity of 87.3% and a specificity of 94.29%. (Table 2.B).

TABLE 2.A

Rural and urban

AV*decimal	M*	H*	A*	Refractive errors
0.1	5	8	13	26
0.2	5	11	18	34
0.3	7	14	19	40
0.4	6	15	17	38
0.5	7	17	19	43
0.6	6	8	22	36
0.7	5	10	16	31
0.8	3	9	15	27
0.9	2	8	11	21
1	2	8	9	19
	48	108	159	315

TABLE 2.B

	M*	H*	A*	Erori refractive
Sensibility (%)	91.67	85.19	87.42	87.3
Specificity (%)	99.38	97.89	97.02	94.29

AV = visual acuity, M = myopia, H = hipermetropia, A = astigmatism

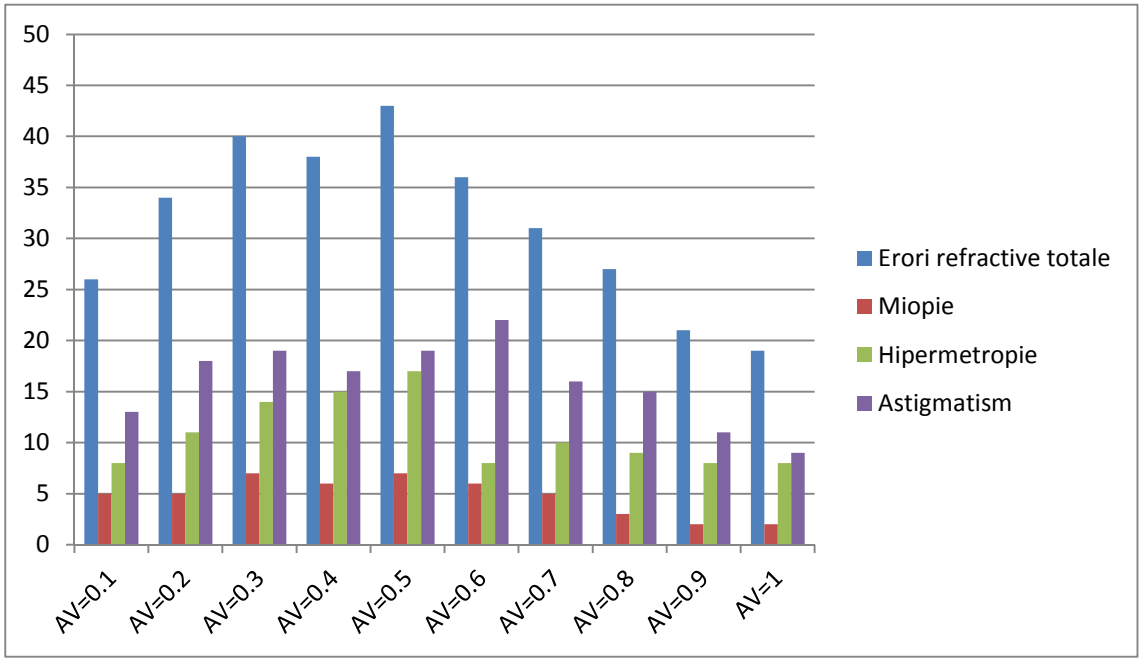

Chart 1. Refractive errors distribution with visual acuity in schoolchildren

Literature research reveals variable data observed on visual acuity screening sensitivity using Snellen type optometers.

An example of this would be the one in Iran, where a study in Dezful, Khuzestan province 13 pupils showed a sensitivity of 25% for these screening tests while some studies have reported sensitivity rates of up to 100 %. (Robinson B. et al., 1999, Khandekar R. et al., 2004, Fotouhi A, et al. 2004. Iran J. 2007).

Within their study in visual acuity screening the sensitivity is 87.3%

Statistics from the literature involving children shows that amblyopia and strabismus are less prevalent even in comparison with the rest of refractive errors. (Wick B. et al., Salomao SR. et al., 2008, Lu Q, et al. 2009) There may be cases of myopia, hypermetropia and astigmatism that through accommodating to compensate refractive defects. The eyes of these patients may not ever ambliopize. However compensatory effort of accommodation can be associated with different subjective and objective complaints and can cause ocular discomfort.

Another study that was conducted in vision screening for students in Baltimore (USA) and in an urban areas in South Korea revealed that refractive errors were more prevalent than amblyopia and strabismus (Ajaiyeoba AI, et al. 2005).

The importance of detecting amblyopia in children should not be underestimated (Preslan MW, et al. 1996) due to long-term adverse consequences and due to the existence of early treatment (Mintz-Hittner HA. et al., 2000) which applied correctly can give surprising results. However, refractive errors in children can affect their educational performance and their psychological health. (Scott WE. et al., 2005, Negrel AD. et al., 2000).

CONCLUSIONS

Visual acuity is a simple and affordable method used in vision screening.

If we only use visual acuity as a method of screening a part of school-age children are not identified with refractive problems.

Minimum and mean refractive errors can be compensated even totally or partially by the accommodative abilities of school children's eyes.

Computerized refractometry in children under cycloplegy is the method of choice in testing students. This method has the advantage of discovering all refractive errors (no matter how small the refractive defect).

Computerized refractometry in children under cycloplegy is a superior method of visual acuity testing, simple and cheap.

We want to propose that standard test method for all school children.

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