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Prevalence of Uncorrected Refractive Errors among Adolescents at King Abdul-Aziz Medical City, Riyadh, Saudi Arabia

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Abstract

Background: Vision disorders are the fourth most common disability in children and uncorrected refractive errors are an important cause of visual impairment in many countries. The present study was conducted to identify the prevalence and pattern of refractive errors among intermediate school entrants (12-13 years) at King Abdulaziz Medical City (KAMC) in Riyadh, Kingdom of Saudi Arabia.

Methods: The study population consisted of all the intermediate school entrants (n=1,536) who attended the mandatory health examination for intermediate-school entry between February 2009 and October 2009. Every student was subjected to a 10-minute vision and auto-refractive test performed by a qualified optometrist. Students with visual acuity of 20/28 (6/9) or worse in one or both eyes, an eye disorder (such as strabismus, nystagmus, ptosis) or abnormal ocular movement were referred for a 45-minute complete ophthalmic examination that consisted of the following: 1) distance visual acuity (V/A), 2) cover – uncover test and 3) non-cycloplegic retinoscopy. The refractive error cut-off point was defined according to the spherical equivalent refractive error (SERE).

Results: Of the 1,536 students, 209 were diagnosed with one or more refractive errors, with an overall prevalence of 9.8% (8.3% in boys and 11.7% in girls, with a significant gender difference) (P=0.033). The prevalence of different refractive errors was as follows: myopia, 4.5% (95% CI, 3.5-.5.5%); hyperopia, 1.5% (95% CI, 0.9-2.1%); astigmatism, 6.5% (95% CI, 5.3-7.7%); and amblyopia, 0.65% (95% CI, 0.25-1.05%).

Conclusion: Our results highlight the need for school–based programs that provide prescription of glasses to students when needed at no cost through government and non-governmental collaborative funds. However, there is a need for further studies to evaluate the cultural beliefs and practice surrounding the use of spectacles in Saudi communities.

Introduction

Vision disorders are the fourth most common disability in children and are the leading cause of disabling conditions in childhood [1]. Uncorrected refractive error is a significant cause of blindness and is the major cause of impaired vision in many countries [2,3].

Vision screening to detect eye problems in school-aged children dates back at least a century [4]. The emphasis was placed on vision screening in the preschool years and preschool screening programs have been adopted in various countries [5]. The purpose of preschool visual screening is to identify children with possible visual problems early, which ensures that the appropriate timely assessment and early intervention are performed as required. Treatment of refractive errors can prevent legal blindness and vision loss [6]. The lack of spectacle provision in eye care services in underserved communities has important consequences in terms of lost educational and employment opportunities, both of which result in impaired quality of life [7] .Previous studies that addressed adolescent screening reported the importance of detection and correction of refractive error [8,9] however, the studies in Saudi Arabia were carried only on preschool (4-6 years) aged children [10,11,12] The Saudi school health services provided by Ministry of Education does lacks adequate vision screening facilities [11]. Medical examinations are mandatory for all school students including intermediate school entrants in accordance with government laws and are authorized by the educational and health authorities at the Ministry of Education. The present study was conducted at the school's heath center at King Abdulaziz Medical City (KAMC) in Riyadh, Kingdom of Saudi Arabia, to estimate the prevalence and pattern of refractive errors among adolescent school students.

Methodology

Study setting

The city of Riyadh has 6 million inhabitants and the population of the National Guard there is approximately 180,000. Of those, 60,000 live in King Abdulaziz National Guard Housing City in the east quarter of Riyadh. A total of 54 schools are located in this city with a student population of approximately 18,000 students. School intermediate entrants, who are 12-13 years old, account for approximately 10% of the total school population. Data was routinely obtained during the medical examinations; however, this study did not involve experimental investigations.

The study population

There were 38 target schools and the target population consisted of 1,536 (734 (47.8%) boys and 802 (52.2%) girls) Saudi children. It

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included all children of both genders ages 12-13 years old and attended the mandatory health examination for intermediate school entrants between February and October 2009. Children who were disabled and those who were younger than 12 years old or older than 14 years old were excluded.

Methods

At the beginning of the 2009-2010 academic years, all adolescent intermediate school entrants were brought by their teachers via school bus to the school health center at KAMC. One part of the medical examination consisted of a 10-minute vision test performed by a qualified optometrist. Adolescents with a visual acuity of 6/9 (20/28) or worse in one or both eyes, an eye disorder (such as strabismus, nystagmus or ptosis) or abnormal ocular movement were referred for a longer 45-minute complete ophthalmic examination within one month that consisted of the following:

Distance visual acuity V/A

All students underwent a full assessment of uncorrected visual acuity; an auto chart projector (ACP-8 Series, Topcon Corporation and Tokyo, Japan) and the Snellen Tumbling E eye chart were used. The adolescents were positioned 6 meters from the well-lit Snellen chart. The visual acuity test was performed on each eye independently; the right eye was tested first with the left eye covered and then the left eye was tested with the right eye covered. The line with the smallest font in which more than half of the letters could be read by the student was recorded.

Cover-uncover test

Eye alignment was assessed using a cover -uncover test at both far (3 m) and near (40 cm) distances. In this test, the screener asked the student to look at a detailed, standardized fixation target and placed a paddle over the student's left eye. The paddle was kept in front of the eye for approximately 3 seconds. The screener observed the unobstructed right eye to determine if refixation occurred. The cover-uncover test was repeated at least 3 times and the test was then conducted with the paddle over the right eye.

Non-cycloplegic retinoscopy

In this test, the screener used a streak retinoscope and a retinoscopy lens rack or handheld trial lenses. The student wore retinoscopy spectacles that corresponded to the screener's working distance to control accommodation.

Power auto-refractor

The Power Refractor II (version 3.11.01.24.00) is a tabletop video/photorefractor that binocularly measures refractive error in 8 meridia and measures eye alignment. When the student fixated on the red and green lights on the camera, the screener began the measurements and continued until the refractive error in each eye and the gaze deviation appeared in green on a display or until the instrument timed out. The screener printed the display image and if the refractive error displayed for either eye was red, the measurements of the highlighted eye(s) were repeated. If the output for either eye was again red, monocular measurements were obtained. The autorefraction results were checked using the retinoscope and the trial lenses, first testing the right eye and then the left eye of each student.

The quantification of refractive error is not straightforward because refraction comprises 3 components, which all contribute to visual acuity: sphere, cylinder and cylinder axis. Refractive error was quantified as the spherical equivalent refractive error (SERE), which is the algebraic sum of the sphere power plus half the cylinder power and is measured in diopter [13].

The refractive error cut-off point was defined according to the SERE, similar to RESC [14] guidline, as follows: emmetropia, SERE between - 0.50 and + 0.50 D sphere; low and high myopia, SERE <– 0.50 D and -6.00 D, respectively [15]; and low and high hyperopia, SERE >+2.00 D and +6.00D, respectively [16].Visual impairment was defined as visual acuity equal to 6/9 (20/28) or worse in the best corrected eye.

Data management

Data was analyzed using the SPSS program. Percentage and 95% confidence intervals were used to describe the prevalence and distribution of the different eye disorders. The Pearson chi–squared test was applied for qualitative data. A P – value of less than 5% was considered statistically significant.

Results

Table 1 shows the distribution of the 1,536 screened high school entrants (734 boys and 802 girls) according to the overall results of the vision screening. Their ages ranged from 12 years to 13 years old. A total of 209 (13.6%) students were detected by the screening and were referred for further examination. Of those 209 children, only 151 children were brought to the final examination by their parents. Those 151 were diagnosed with one or more eye problems; this constituted an overall prevalence of 9.8% (8.3% for boys and 11.7% for girls). There was a significant gender difference in terms of the prevalence of refractive errors (X^2 =4.54, P =0.033). In our study, we found that 23 (15.3%) children with refractive error used spectacles.

Table 2 shows the distribution of those 151 children with refractive errors according to the different abnormalities; more than half

A)

GENDER	No. Screened	No. Referred (%)	ABNORMAL [b] N %	95%CI
BOY'S	734	80 (10.9)	61	8.31
GIRL'S	802	129 (16.1)	94	11.7
TOTAL	1536	209 (13.6)	151	9.8

B)

GENDER	No. screened	Referred (%)	ABNORMAL N	%	95%CI	Sex differences
BOY'S	577	36 (6.2)	24	4.2	3.1:5.3	
						X^2 = 0.22
GIRL'S	742	56 (7.5)	36	4.9	(3.7:5.1)	
						P = 0.64
TOTAL	1319	92 (7.0)	60	4.5	3.4:5.6	

Chi - squared test (sex differences) x^2 = 4.54 and P = 0.033
@ Yates corrected chi- squared test was applied.
(b) abnormal denotes any child whose vision in one or both eyes is equal or less than 6/9(20:28)

Table 1: Distribution of adolescent school children according to the over-all results of vision screening.

Refractive Errors	cases (n = 151)		Prevalence (%) (N =1536)	95% CI
	n	%		
Myopia	87	57.6	5.7	4.5-6.9
Mild (- 0.5 D < - 3 D)	69	45.7	4.5	3.5-5.5
Moderate (- 3 D < - 6 D)	13	8.6	.85	0.35-1.35
High (> - 6 D)	5	3.3	.33	0.03-0.63
Hyperopia	23	15.2	1.5	0.9-2.1
Mild (+ 0.5 D < 3 D)	15	9.9	.98	0.48-1.48
Mod. (+3 D <+ 6 D)	7	4.6	.46	0.16-0.76
High (> + 6 D)	1	.7	.07	-0.03-0.17
EmEmmetropia	41	27.2	2.7	1.9-3.5
Astigmatism	100	66.2	6.5	5.3-7.7

Overall prevalence is 9.83% (95% CI: 8.33-11.33)

Table 2: Prevalence of Refractive errors among adolescent school children of KAMC- Riyadh.

of these children suffered from myopia (57.6%) with an overall prevalence of 4.5% (95% CI, 3.5-5.5%). However, those with high myopia constituted 3.3% of all the children with myopia. Astigmatism was shown in three-quarters of the children with myopia with a prevalence of 6.5% (95% CI, 5.3-7.7%). Emmetropia was ranked third among the eye disorders with a prevalence of 2.7% (95% CI, 1.9-3.5%) and hyperopia was ranked fourth with a prevalence of 1.5% (95% CI, 0.9-2.1%). Ten children with amblyopia were detected after the exclusion of other eye abnormalities with a prevalence of 0.65% (95% CI, 0.25-1.05%).

Discussion

The prevalence of refractive errors in our study was 9.8% and the prevalence was significantly higher among girls ($P<0.033$) compared to boys; these values are far lower than the 20.6% prevalence described in an Egyptian community [17] and are similar to the 11.4% prevalence shown in an Australian study [16].However, these prevalence values are much greater than those of a similar age group in Tanzania (6.9%) [18] Ghana (7%) [19], Oman [20] and India (6.4% [20], although those studies used a lower cut-off value of 6/12 (20/40) compared to that of our study, 6/9 (20/30).

The prevalence of myopia in adolescents varies in different countries. In our study, the prevalence was 5.4% (at least -0.50 D), which is similar to the 6.1% (<-0.5 D) prevalence reported in Morocco [22], less than the 12.8%, 13% and 9.7% prevalence reported in Danish [23], Polish [24] and Indian [21] populations, respectively and greater than the 3.4% prevalence reported in an Iranian Studies [25,26].

The prevalence of hyperopia has varied in studies of different populations depending on the diagnostic criteria used. In our study, the prevalence of hyperopia was 1.5% (at SERE>+2.0 D), which is similar to the 1.8% prevalence in a South African [27] study and the 2.1% prevalence in an Iranian study [25]; however, this is less than the 5%, 5% and 4.3% prevalence that was reported in Indian [21], Australian [16] and Singaporean [28] studies (SERE+ 2.00 D or more), respectively.

The prevalence of astigmatism has also varied in studies of different populations. In our study, it was 6.5%, which is less than the 9.6% and 9.7% prevalence reported in a South African [27] and Iranian [25,26] studies, respectively, but greater than the 4% prevalence shown in a Polish population [24].

The emmetropia in our study represented 27.2% of all refractive errors and this may be due to our high cut–off value of 6/9 (20/28) which may be were sensitive but not specific. We suggest using a lower cut-off value for this age group of 6/12 (20/40), which has been accepted by many researchers [9, 26&29] as a cut-off value to define uncorrected refractive error. The 6/12 (20/40) cut-off has also been accepted for legal driver's licenses and is a value that is between our 6/9 cut-off and the 6/18 cut-off that is used by the WHO criterion for moderate visual impairment. Consistent with the WHO's global initiative, "Vision 2020: The right to sight" [30], a professional-based (optometry) screening program for all school children is recommended to provide early detection and to initiate early treatment. Our results highlight the need for school-based programs that provide prescription glasses to students when needed at no cost through government and non-governmental collaborative funds, especially that only 15.3% of those detected with refractive error use spectacles. This is to be accompanied by education and awareness campaigns to ensure that the corrections are used and cultural barriers to compliance are addressed and removed. However, there is a need for further studies to evaluate the cultural beliefs surrounding the use of spectacles in Saudi communities.

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