The Prevalence of Refractive Errors Among Iranian University Students

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The Prevalence of Refractive Errors
Among Iranian University Students

Hassan Hashemi, MD[1] • Mehdi Khabazkhoob, PhD[2] • Negareh Yazdani, MSc[3]
Hadi Ostadimoghaddam, PhD[3,4] • Akbar Derakhshan, MD[5] • Sara Soroush, MSc[1]
MirNaghi Mousavi, MD[5] • Saman Mohazzab-Torabi, MD[1]
Nooshin Dadbin, MSc[1] • AbbasAli Yekta, PhD[3,4]

Abstract

Purpose: To determine the prevalence of refractive errors in the students of Mashhad University of Medical Sciences, Iran

Methods: In this cross-sectional study, we used cluster sampling for selecting participants from every department of Mashhad University of Medical Sciences, proportional to the number of students in each department. Each participant received refraction examination with an auto-refractometer and check up with a retinoscope. Myopia and hyperopia were defined as spherical equivalent (SE) less than -0.5 and more than +0.5 D, respectively. Astigmatism was defined as cylinder power worse than 0.5 D.

Results: Out of 1,745 selected individuals, the data of 1,431 participants were analyzed after implementing the exclusion criteria; 58.8% of the participants were female and the mean age of the participants was 23.8±3.8 years (range, 18-32 years). Myopia, hyperopia, and astigmatism were seen in 41.7% (95%CI 38.7-44.7), 7.8% (95%CI 6.2-9.4), and 25.6% (95%CI 23-28.3) of the students in this study, respectively. The prevalence of myopia increased significantly with age (OR=1.16 1.12-1.20 p<0.001). The prevalence of hyperopia was significantly higher in females (OR=2.1 1.1-3.7 p=0.025) and decreased significantly with age (OR=0.87 0.81-0.94 p=0.001). The prevalence of astigmatism increased significantly with age. Moreover, 6% of the students had anisometropia and 1.2% had high myopia.

Conclusion: The prevalence of myopia was considerably high in these students; therefore, attention to this age group to identify and correct the refractive errors should receive priority in the health system.

Keywords: Cross-Sectional Study, Prevalence, Myopia, Hyperopia, Astigmatism, University Student

1. Noor Ophthalmology Research Center, Noor Eye Hospital, Tehran, Iran
2. Department of Epidemiology, Faculty of Public Health, Shahid Beheshti University of Medical Sciences, Tehran, Iran
3. Refractive Errors Research Center, School of Paramedical Sciences, Mashhad University of Medical Sciences, Mashhad, Iran
4. Department of Optometry, School of Paramedical Sciences, Mashhad University of Medical Sciences, Mashhad, Iran
5. Khatam-al-Anbia Hospital, Mashhad University of Medical Sciences, Mashhad, Iran

Correspondence to: *AbbasAli Yekta, PhD*
Refractive Errors Research Center, School of Paramedical Sciences, Mashhad University of Medical Sciences, Mashhad, Iran
Department of Optometry, School of Paramedical Sciences, Mashhad University of Medical Sciences, Mashhad, Iran
Email: yektaa@mums.ac.ir

Introduction

Refractive errors are the primary cause of visual impairment.[1] Although they can be easily corrected with glasses or the contact lens, they can lead to visual impairment or even blindness in some countries.[1] Numerous epidemiologic studies have increased our knowledge of refractive errors in different parts of the world.[2-15] Evaluation of the demographic, environmental, genetic, and ethnic factors in refractive errors has illustrated the role of each one in these errors.[16,17] Regarding the refractive errors changes with age, we already know that a person is hyperopic in the early years of life and becomes myopic with the increase in age but again there is a hyperopic shift after forty years of age.[18] We know that the prevalence of myopia is high in East Asian countries and the role of some genes in myopia has been identified.[10,14,15] Researchers have paid attention to the prevalence of these errors in different age groups, from children[6,12,19-25] to the elderly.[13,15,22,26-31] The prevalence of the refractive errors has been reported from less than 1%[32] to 16%[5] in children and from 20% to more than 70% in older age groups. Numerous studies on the prevalence of refractive errors and ocular problems have been conducted by Iranian researchers in different parts of Iran and as a result,[5,12,19,27,33-35] our information on preschool and school aged children is almost complete and there are reports on the old age. However, no study has exclusively evaluated Iranian young adults, specially university students. Awareness of the refractive errors in this age group elucidates their visual problems; furthermore, because refractive surgery is often performed after 18 years of age, it can show what percentage of the population will require refractive surgery in the coming years which allows for better accessibility and planning. We designed and performed this study to determine the prevalence of refractive errors, specially myopia, in Iranian university students. This study exclusively evaluated refractive errors in this age group for the first time.

Methods

This cross sectional study was performed in 2013. The target population of the study was the students of Mashhad University of Medical Sciences. In this cross-sectional study, we used cluster sampling for selecting participants from every department of Mashhad University of Medical Sciences, proportional to the number of students in each department. The selected students were invited to participate in the study. All examinations were performed in one place. Consent was obtained from students after they agreed to participate in the study. In the first step, the participants answered a number of demographic questions in an interview and then, the examinations were performed.

Examinations

Students entered the study if they had no prior history of refractive or any kind of ocular surgery. Non-cycloplegic autorefraction was performed five times for each eye by an experienced optometrist using an auto-refractometer (Topcon RM8800, Topcon Corporation, Tokyo, Japan) and the mean value was recorded. The results of autorefraction were then refined with retinoscopy (HEINE BETA 200, HEINE Optotechnic, Germany) and a lens set (MSD Meniscus Trial Lenses, Italy). Then, if the student used glasses, visual acuity was measured with his/her glasses using an E-optotype Snellen chart at 6 m. After that, lensometry was performed (Topcon LM 800, Topcon Corporation, Tokyo, Japan), and the lens power and prescription time were recorded. In the next stage, uncorrected visual acuity was measured in all students.

Definitions

In this study, myopia and hyperopia were defined as a spherical equivalent (SE) less than -0.5 and more than 0.5 D, respectively.[15,36-39] Astigmatism was defined as cylinder power more than 0.5 D (the cylinder power was recorded as a negative value). Anisometropia was present if the SE difference of the eyes was 1 D or more. Regarding the severity of the refractive errors, SE less than -6 D was regarded as severe myopia, SE between -3.1 and -6 D was regarded as moderate myopia, and SE between -0.51 and -3 D was considered mild myopia. SE between 0.51 D and 2 D, between 2.1 D and 4 D, and more than 4 D was defined as mild, moderate, and severe

hyperopia, respectively. Astigmatism axis was classified as with-the-rule (WTR) if the axis was between 150⁰ and 180⁰ or between 0⁰ and 30⁰, against-the-rule (ATR) if the axis was between 60⁰ and 120⁰ and oblique if else.

Data analysis

In this study, the prevalence of refractive errors was reported as percentage with a 95% confidence interval. After descriptive analysis, logistic regression was used to investigate the correlation of refractive errors with variables such as age and sex.

Ethical issues

Each student signed an inform consent form prior to participation after receiving information on the objective of the study. Before the examinations, the Ethics Committee of Mashhad University of Medical Sciences approved the study proposal.

Results

In this study, out of 1,745 selected students, 1,454 agreed to participate in the study. Twenty three students were excluded from the study due to the positive history of refractive surgery; therefore, analysis was performed on 1,431 participants. About 58.8% (n=842) of the participants were female. The mean age of the participants was 23.8±3.8 years (range: 18-32 years). The correlation of the SE between the two eyes was 0.886 and therefore the results of the right eye were analyzed. The mean SE of the participants was -1.2±2.0 D (range, -9.25-6.38 D). The mean SE did not show any significant difference between male and female participants (p=0.591). The mean SE showed a myopic shift with the increase in age (p<0.001). Table 1 presents the prevalence of different types of refractive errors based on age and sex. According to table 1, 41.7% (95%CI 38.7-44.7) of the students were myopic. We noticed no significant relationship between the prevalence of myopia and sex (p=0.370, OR=1.14 0.86-1.5). However, according to table 1, the prevalence of myopia increased from 27.9% in the age group 18-20 years to 71.6% in participants older than 30 years of age (p<0.001, OR=1.16 1.12-1.20). On the other hand, 7.8% (95%CI 6.2-9.4) of the students were hyperopic. According to table 1, the prevalence of hyperopia was significantly higher in female students (p=0.025, OR=2.1 1.1-3.7) and significantly decreased with aging (p=0.001, OR=0.87 0.81-0.94).

The prevalence of astigmatism was 25.6% (95%CI 23-28.3) in the participants with no significant difference between males and females (p=0.131). However, the prevalence of astigmatism increased significantly with aging (p=0.001, OR=1.13). The prevalence of WTR, ATR, and oblique astigmatism was 17.9%, 5.2%, and 2.6% in our study population. No significant difference was observed in the type of astigmatism between male and female students (p=0.404). The prevalence of ATR astigmatism increased significantly with age (p=0.001). Anisometropia was found in 6% of the students and was significantly higher in male students (p<0.001) and increased in a non-linear fashion with age (χ^2 for trend, p=0.019). According to the findings of this study, the prevalence of severe, moderate, and mild myopia was 1.2%, 21.1%, and 19.4% in the participating students. Furthermore, 7.7% of the students had mild hyperopia and 0.1% had severe hyperopia. Severe myopia was more prevalent in male versus female students (p<0.001).

Table 1. The prevalence of myopia, hyperopia, astigmatism and anisometropia in medical student of mashhad

	Myopia	Hyperopia	Astigmatism	Anisometropia
Age	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)
18-20	27.9 (22.7-33.1)	10.3 (6.8-13.9)	17.2 (12.9-21.6)	4.5 (2.1-6.9)
21-23	36.5 (31.5-41.4)	10.2 (7.1-13.4)	22.7 (18.3-27.0)	5.8 (3.4-8.2)
24-26	48.9 (41.4-56.3)	2.8 (0.4-5.3)	28.4 (21.7-35.1)	2.8 (0.4-5.3)
27-29	54.8 (45.1-64.5)	4.8 (0.6-9.0)	30.8 (21.7-39.8)	12.5 (6.0-19)
≥30	71.6 (63.0-80.2)	3.7 (0.1-7.3)	48.6 (39.1-58.2)	9.2 (3.7-14.7)
Female	42.5 (39.0-46.0)	8.9 (6.9-11)	24.4 (21.4-27.5)	4.5 (3.0-5.9)
Male	39.4 (33.7-45.2)	4.7 (2.2-7.1)	29.0 (23.7-34.4)	10.0 (6.5-13.6)
Total	41.7 (38.7-44.7)	7.8 (6.2-9.4)	25.6 (23.0-28.3)	6.0 (4.5-7.4)

Discussion

Numerous reports on refractive errors have been published from Iran.[5,12,19,34,40] However, the results of the present study showed that the pattern of refractive errors was different in university students when compared to other groups and therefore they could be considered a high risk group. The distribution of refractive errors was different in this group in comparison with similar age-matched normal groups. Considering the results of this study, 41.7% of the students were myopic. Considering the results of this study and according to table 2 which shows the results of other studies from Iran, the prevalence of myopia is higher in university students compared to school-aged children, even higher than same age group in Tehran and Mashhad studies.[41,42] The prevalence of myopia in our study was almost similar to its prevalence in the elderly population.[27,41,42] Comparison of the results of this study with other studies worldwide confirms this finding because the prevalence of myopia in East Asian countries in which myopia is rather similar to our study.[15,21,26,28] Onal et al[43] reported a prevalence of about 32% for myopia in Turkish university students; although the reported prevalence was high, it was lower than the prevalence of myopia in our study. Sun et al[44] reported that more than 90% of the university students had myopia.

Table 2. Summary of other studies concerning myopia and hyperopia in Iran

City of Iran	Age (years)	Myopia (%)	Hyperopia (%)
Dezful[5]	7-15	3.4	16.6
Shiraz[19]	7-15	4.4	5.0
Bojnourd[12]	6-17	4.3	5.4
Shahroud[34]	40-64	38.3	22.1
Mashhad[41]	1-90	17.9	41.38
Tehran[42]	5-90	17.2	56.5

The high prevalence of myopia in our study shows refractive errors should receive more attention in university students because myopia is the most common cause of uncorrected refractive error. It seems that studying hard for the university entrance exam, which imposes a high load of near activity, is the reason for the high prevalence of myopia in this age group.

Regarding hyperopia, 7.8% of the students were hyperopic, which is concordant with the results of other studies on the prevalence of hyperopia in university students[41-43]; therefore, hyperopia is not a concerning issue in our university students. Since hyperopia and myopia are optically opposite each other, the myopic shift in university students is the reason for the low prevalence of hyperopia in them. As mentioned earlier, there was no significant difference in myopia between male and female students while hyperopia was more prevalent in females. Regarding myopia, studies on different age groups have reported different findings but most studies have shown a higher prevalence of myopia in males.[27,29,34,45-47] The prevalence of hyperopia was higher in our female students, which is concordant with other studies.[27,29,34,46] The differences in the distribution of the biometric components of the eye can explain this difference. Most studies have shown that the axial length is shorter in women[48-50]; since short axial length is related to hyperopia, the shorter axial length in females can be the reason for the higher prevalence of hyperopia in them.[49,51] Our findings showed that the prevalence of myopia increased linearly with age while the prevalence of hyperopia decreased with age. The changes in the refractive errors with age have been investigated in many studies.[14,27,37,40,41,46] The decrease in hyperopia and increase in myopia from childhood to adolescence have been reported in several studies[12,32,52] which are believed to result from the changes in the ocular structure, specially the axial length. However, the changes in the refractive errors after 20 years of age,[53-55] when ocular growth has reached its plateau, are caused by other factors. It seems that environmental factors, specially near work, are the most important reason in this regard. It should be noted that the increasing trend of the prevalence of myopia with age is seen up the fourth decade of life because a number of studies have shown a hyperopic shift after forty years of age due to changes in the lens structure.[18,56,57] However, there are reports of the increase in the prevalence of myopia after forty years of age mainly due to nuclear cataract[27,37,39,47]; therefore, this finding cannot be generalized to healthy populations.

One out of four students in our study had astigmatism. It is rather difficult to discuss astigmatism in university students since a limited number of studies have investigated astigmatism in this age group; however, our findings showed that the prevalence of astigmatism in university students was higher than children and lower than elderly people.[12,58] In other words, its prevalence was midrange in our study population. As mentioned earlier, the prevalence of astigmatism increased significantly with age. This finding has been reported in other cross sectional and cohort studies, as well. Asano[59], and Baldwin[60] believed that the changes in the prevalence of astigmatism with age were mainly due to corneal changes and steepening of its curvature and reported that lens astigmatism did not change significantly with age. Our findings did not show any significant difference in the prevalence of astigmatism between male and female students. Although there are contradictory reports regarding the correlation of the gender and astigmatism prevalence, the majority of the studies have found no relationship. However, some studies have reported a higher prevalence in males or vice versa. As a result, we cannot comment on the correlation of astigmatism and sex in this age group. Similar to other studies, we noticed an increase in the prevalence of ATR astigmatism with age. This finding has been already confirmed and attributed to the decreased eyelid pressure on the cornea.

Conclusion

The prevalence of myopia is considerably high in Iranian university students. There should be screening programs to find the undetected cases of myopia in university students due to the importance of this refractive error and the large amount of near work in them. Correction of myopia can decrease the prevalence of visual impairment, as well.

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