IJMS
Vol 31, No 4, December 2006

Original Article

Effects of Various Risk Factors on Myopia Progression

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Abstract

Background: Myopia has different prevalence rate worldwide and there is controversial points about its environmental risk factors. The prevalence of myopia in medical interns at Shiraz Medical School and its probable risk factors were studied.

Method: In this retrospective cross-sectional study, three hundred interns (7^{th}-year medical students) at Shiraz University of Medical Sciences were examined by auto refractometer and subjective refraction. We Also administered a questionnaire to evaluate the age of the onset of myopia, the power of the first spectacles, and its power in the first year of medical school, parental refractive error, prematurity, mean amount of time spent for studying, sleeping, and TV watching per day among myopic students and a comparable control group.

Results: Ninety-two out of 300 (31%) interns had myopia over 0.5 diopters with similar age, sex, time spent for sleeping and studying as 88 randomly selected non-myopic controls. Parental myopia was reported in 54% of cases and 25% of controls ($p<0.05$). 60% of myopic interns had more than 0.75 diopters of progression during medical school years with similar age, sex, and time spent for sleeping and studying as 40% with less than 0.75 diopters of progression. Mean age of onset of myopia was 17.00±2.88 years with mean initial amount of -0.96±0.45 diopters in former subgroup, but in the latter subgroup, these were 13.84±2.99 years and -1.37±1.40 diopters, respectively ($p<0.05$).

Conclusion: Those students with myopia progression during medical study had later onset with less amounts of initial myopia than those without progression during the same period.
Iran J Med Sci 2006; 31(4): 204-207.

Keywords ● Myopia ● myopia progression ● nearwork

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Introduction

Nearsightedness or myopia is a vision condition in which near objects are seen clearly, but distant ones do not come into proper focus. It is the most common vision condition affecting nearly 30% of the US young adult population and approximately 50% of the US and European medical students.[1,2] The specific risk factors for myopia, its progression, and its worldwide prevalence are not clear, but available data suggest a multifactorial cause with interplays ,

between genetic and environmental factors. The supposed risk factors include nearwork, prematurity, day/night sleep pattern levels of education, the use of sleep light, parental history of myopia, circadian patterns of light and dark.[3] The present study was designed to asses the prevalence of myopia and the risk factors affecting its progression among highly educated young adults with presumed risks of myopia progression.

Participants and Methods

The participants were 300 medical interns (7th year medical students) who have entered Shiraz medical school in the academic year 1996-1997. At first, the study was explained to them and a written consent was obtained. In order to find the prevalence of myopia, all participants were examined for myopia using non cycloplegic automated refraction and subjective best corrected visual acuity assessment.

In order to record the exact amounts of refractive errors, the participants' Spherical Equivalents were determined by adding their half amounts of astigmatism to their myopia. Myopia was then defined as the mean spherical equivalent of the two eyes of ≥0.5 diopters. Based on this definition 92 (31%) students were diagnosed as having myopia.

Afterwards, the myopic interns were invited for interviews using a questionnaire designed to assess the age at the onset of myopia, and the power of the first spectacles as well as its calculated spherical equivalent, and its power in the first year of medical school. The questionnaire also included likely risk factors for myopia progression including the history of parental myopia, prematurity, average daily time spent for study, watching TV, and sleep. The eye examinations and interviews were performed by a single ophthalmologist. In addition, a control group consisted of 88 interns were selected randomly from the remaining 208 non-myopic interns and evaluated using the same questionnaire.

In some participants the amount of the current refractive error and the amount of refractive error at the start of medical school were different in right (OD) and left (OS) eyes, so the larger amount was used in the study. The spherical equivalent of the first spectacles and the amount of this variable at the beginning of the medical education were determined based on the participants' history because there was no report or old chart to find such values.

Significant progression of myopia was defined as increase in myopia more than 0.75 diopters during the years of medical education. The myopic interns were divided into two subgroups. Subgroup A consisted of those whose myopia had progressed significantly (≥0.75 diopters) and subgroup B whose myopia had no progression or progressed less than 0.75 diopters during the course of medical education.

Statistical analyses

Data were expressed as mean±SD. For the comparison of continuous and non-continuous data of both groups Student's *t* and Chi-square tests were used and $P<0.05$ was considered significant.

Results

Ninety-two (31%) of the 300 participants were myopic (with spherical equivalents ≥0.5 diopters). Sixty-four (69.6%) of the myopic students were male and their mean age was 24.52±1.27 years. Among 88 non-myopic interns (control group), Sixty-two (70.4%) were male with a mean age of 25.10±1.83 years. There were no statistically significant differences regarding the demographic characteristics between the myopic and control participant. Potential risk factors for myopia and its progression in the myopic and control groups are shown in Table 1.

Table 1: Potential risk factors for myopia and its progression between medical interns and the control group.

		Control	Case
Time spent as		hrs/day	hrs/day
Academic	Sleep	7.81±1.2	8.1±1.4
	Study	2.9 ± 1.8	3.3 ±2.0
	TV	1.7 ± 1.4	2.5± 1.9*
Summer	Study	2.0±1.8	2.4± 2.3
	TV	3.0±1.9	4.1± 2.6*
History		n (%)	n (%)
Use of sleep light		7(8)	5 (5.4)
local light for study		23 (26)	22 (24)
Prematurity		0%	2.2
Myopia in one or both parents		18 (20)	50 (54)*

* (P<0.05)

Myopic students spent a significantly higher daily time watching TV during academic years (2.5±1.9 hours) and during holidays (4.05±2.59 hours) than those of the control group. However, there was no statistically significant difference in the other potential risk factors for myopia progression between the two groups. Fifty four percent (n=50) of myopic subjects had a positive history of parental myopia, which was considerably higher than that non-myopic students (20%). Two myopic participants had a positive history of prematurity, while none of the participants in the control group had such a history.

The amount of progression of myopia in subgroup A (-1.25 dioptre) was more than that in non-progressive cases (-0.375 dioptre). Table 2 shows the baseline characteristics and the similarity of age, sex, the time spent for sleeping, studying, and TV watching during medical school years of the two subgroups A and B.

Table 2: Potential risk factors for myopia and its progression among participants with significant increase in myopia (Group A) and the other myopic subjects (Group B)

		Group A n=55	Group B n=37
M/F ratio		2.06	2.70
Age (yr)		24.38±0.93	24.73±1.64
Age at onset (yr)		17.00±2.88	13.84±2.99*
Study time (hours)		3.39 ±2.19	3.21 ± 1.72
Watching TV (hours)		1.49±1.34	2.01±1.50
Power (diopters)	diagnosis	-0.96±0.45	-1.37±1.40*
	Current	-2.79±1.44	-3.07±2.18

*Statistical Difference is significant. (p<0.05)

In the progressive cases (subgroup A), the mean age of onset of myopia was 17.00±2.88 years with mean initial power of -0.96±0.45 dioptre but in non-progressive cases (subgroup B), they were 13.84±2.99 years and -1.37±1.40 diopter, respectively.

Discussion

Although our data about myopia progression and its risk factors were collected through a questionnaire, the high academic standing of medical students and the emphasis on recent behavioral habits during medical school decrease some of the potential sources of recall bias. In addition, some studies show that if a medical condition is serious, or affects the respondent's everyday activities, or represents a significant "life event", the medical data are more likely to be reported accurately by respondents.[4]

The present study showed that the prevalence of myopia in medical interns at Shiraz Medical School was 31% which was much lower than of the prevalence in US and European medical students (50%),[1] last-year US law students (66%),[5] and Singapore medical students (82%).[6] Our study showed that the refractive powers among myopic freshman students and last-year medical students at Shiraz Medical School were -1.96±1.88 dioptre and -2.90±1.77 dioptre, respectively. Such values were much lower than those for Singapore medical students.[6]

Education is strongly associated with increased myopia suggesting that our medical interns had a higher prevalence than the general population in living in Tehran.[7] The study also showed that there was no correlation between myopia progression and the use of sleep light, or daily duration of the study (Table 1). The lack of association between myopia and night light found here was in agreement with the reports of investigators.[8-10] The present study, however, in contrast to the previous reports,[5,11-13] failed to show a correlation between nearwork and myopia.

The daily study hours for medical interns were 3.32±2.00 hours, which was considerably, lower than that for medical students in US and Europe or most Taiwanese school children.[2,11] Some investigators have indicated that study time has a critical threshold and more than it may induce myopia.[13,14] Therefore, we think the reason for not seeing a correlation between the duration of the study time and myopia in our study might have been due to the fact that the times spent for the study were less than the critical threshold for inducing myopia.

Other reasons for not seeing an association between nearwork and myopia development might be the low prevalence of myopia in our students. From the standpoint of epidemiologic principles, as concluded by Angle and colleagues, if a population reveals a low prevalence of myopia, it will be relatively difficult to determine the role of environmental factors in the etiology of ocular refraction.[1] The next likely reason might be the different needs for accommodation for different alphabets, as is suggested about the accommodations in regard of reading Chinese or English alphabet.[3]

A significant difference was found between the durations of TV watching and myopia in the case and control groups. The accommodation required for reading is assumed as being three-fold more than that required for watching TV. This is so because in regard to the usual distance for these two tasks different amounts of magnification are required.[5] However, it is not clear why in the present study TV watching was more important in the development of myopia than reading.

Reports have revealed that in younger children (less than 6 years of age) the axial length of the eye increases more rapidly than older ones, so nearwork at later childhood seems to induce myopia less effectively than during early childhood.[12,14] Although, most interns that participated in this study mentioned that during their early childhood they had daily hours of TV watching routinely, without having a regular habit for daily studying, we cannot make a conclusive association between their childhood habit and the prevalence of myopia.

The present study also showed that 2.2% of the myopic students had a history of prematurity, similar to the rate reported for the US myopic law students.[5] Although, this rate is statistically insignificant, but it is clinically important,

because Ziylan and colleagues have indicated that myopia is more frequently seen in adulthood of regressed retinopathy of prematurity.[15]

Our study also pointed out a positive correlation between parental history for myopia progression and the prevalence of myopia, similar to the previous reports,[1,16-18] Our conclusion has the support of Edwards et al. who showed a genetic influence on the population who did not have nearwork activity.[19] Therefore, we suggest that, as of the previous studies,[20] myopia seen in our study might have been related to the genetic and congenital factors rather than nearwork.

It is important to mention that myopia in subgroup B had started during childhood and early adolescent ages (13.84±2.99 years). Therefore, the full development of myopia might have started much before their entry to the medical school, but remained stable during their medical school years. Whereas, in subgroup A, myopia started at older ages (17.00±2.88 years) and its progression continued during medical school years. These findings indicate that axial elongation of the eye in our study population may have a bimodal pattern, one myopia may have started and stopped earlier and the other it occurred late and stopped at older ages, nevertheless, more studies are needed to verify such a conclusion.

Conclusion

The progression of myopia in adulthood was more likely to occur in later-onset myopia. However, this is still a preliminary finding and further large-scale studies on other populations should be done to verify our results.

Acknowledgements

The authors would like to thank Miss. Zahra Shayan and the other staff at the center for Development of Clinical Research of Nemazee Hospital for statistical assistance.

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