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Prevalence of Refractive Errors and its Associated Factors among Female Students of King Saud University, Riyadh

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Abstract

Introduction: To quantify the prevalence of refractive errors and its associated factors among female students of King Saud University (KSU) and to compare different methods of correction and also pattern of adherence towards the guidelines for wearing contact lenses between medical and non-medical female students.

Study design: An observational quantitative cross sectional study.

Material and methods: This study was conducted amongst 345, 3rd and 4th year female students at female academic medical center and female Business College in KSU, Riyadh, Saudi Arabia during Jan.to March, 2013. A well-structured pre-tested questionnaire was used to collect the data. The data was analyzed with SPSS 21.0 version statistical package.

Results: The prevalence of refractive error among female students was 55.4% (191 out of 345). Refractive errors were significantly higher in medical students than non-medical students with percentages of 61.3% and 49.4% respectively. A statistical significant association was observed between developing refractive errors and spending long hours in front of computer screen. Non-medical students adhere more to guidelines for wearing contact lenses when compared to medical students.

Conclusions: A higher proportion of female students in KSU have refractive errors, in which medical students were more affected than non-medical students. Students who are at high risk (e.g. family history, exposed to near work) should be aware about the problem and start preventive measures early. Further studies are needed to find out why medical students take less care about their medical problems.

Key words: contact lenses, medical students, myopia, near work, refractive errors, risk factors.

Introduction

Refractive errors are common especially in the young academically active population. Several studies have been made in different universities to document the prevalence of these refractive errors [1]. Over the past few decades, refractive

errors were suggested to be as a result from a combination of hereditary and environmental factors. And, there has been a dramatic increase in its prevalence rates in different parts of the world with different population groups in relation to their educational level. Refractive errors were seen in 126, according to WHO classification of visual impairment, 115 patients had visual impairment and 11 had blindness. Refractive errors are the most common causes of visual impairment in children of urban population [2]. Among the three types of refractive errors (Myopia, Hyperopia and Astigmatism), Myopia appears to be the most

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common. In fact, Myopia is one of the most prevalent disorders of the eye. Higher myopia is associated with comorbidities that increase risks of severe and irreversible loss of vision, such as retinal detachment, sub retinal neovascularization, dense cataract, and glaucoma [3]. The exact cause of myopia is unknown. However, heredity and visual stress are the main factors responsible for its development. On the other hand, there is no significant relation between myopia and BMI, and it is not affected by gender nor genetic inheritance plays a role [1]. Previous studies have shown that university students, especially medical students are at a higher risk of developing refractive errors such as myopia during their educational life, and that myopic progression or development is more likely in medical students in their early 20s than in their late 20s, possibly as a result of extensive studying [4]. For instance, a cross-sectional descriptive study among medical students in AIMST University in Malaysia concluded that, the frequency of refractive errors among medical students was high, and the most common refractive error was myopia [5]. And, most of the studies concluded that medical students are at high risk for refractive errors development due to the extensive educational efforts, which has an impact on the progression of new cases of myopia among medical students. The prevalence, has been found to vary from 16-70% in different populations [6]. However, the general population had a significantly lower prevalence of myopia and a higher prevalence of hyperopia than the young educated group population, who had higher prevalence of myopia. Based on this it seems to be important to try to obtain similar knowledge about the refractive state of different population groups [7]. Also, refractive errors prevalence appears to be increasing among economically developed societies worldwide. Locally, a study was done to estimate the prevalence of visual impairment, its causes and associated factors

among the adult population in Aljouf, Saudi Arabia. It was done during the year 2005, on a sample of 620 Saudi adults, of age 18 years and older. The overall prevalence of visual impairment was 13.9%. The principal causes of visual impairments were refractive errors 36% [8]. In addition, a study was done in King Abdul Aziz Medical City, Riyadh, Saudi Arabia. It was conducted to estimate the prevalence of refractive errors among intermediate school entrants. Data was collected from all students who attended the mandatory health examination that is required for intermediate school entry. Age of students ranged from 12 to 13 years. 1536 students were examined, 9.8% were diagnosed with refractive errors, with a gender difference (more in girls). Myopia was the commonest refractive error [9]. A review by the national health and medical research council had found excessive reading as one of the risk factor [10]. So, it is relevant to study whether intensive physical activities such as reading or studying have an effect in developing or progressing refractive errors such as myopia, comparing medical to non-medical students since medical students are exposed to intensive learning process in compare with other students. The relation between myopia and intensive educational effort was discussed several times, and it was shown the prevalence of myopia increased markedly among medical students, which confirms the association of near work activity and myopia. One third of medical students who were not myopic at the time of enrolment developed myopia, while other medical students who were already myopic showed myopic progression [6].

Refractive errors can be corrected by different ways, by spectacles, contact lens or by refractive surgeries. Spectacles are considered to be the simplest of the three options; therefore it is the most commonly used form of refractive correction. However, the choice from these options absolutely varies with individual

Table.1: Prevalence of refractive errors

Subjects	No. of subjects	Presence of Refractive errors (%)*	95% Confidence Interval for % of refractive errors
All	345	191(55.4)	49.98% to 60.72%
Medical	173	106(61.3)	53.61% to 68.60%
Non-medical	172	85(49.4)	41.70 % to 57.12%

* p= 0.03 (comparison between medical and non medical subjects

depending on several factors such as affordability, place and nature of work, profession, socioeconomic status and hobbies [11]. Between the three options, contact lens has been providing vision to millions of users worldwide. 125 million all over the world use contact lens as a primary form of refractive correction [11]. It plays an important role due to the advantages it serves like comfort, quality vision, convenience and other optical advantages [12]. Apart from the natural look it provides it also has a cosmetic effect; it opens the door for unlimited choices of colored lenses that are used as cosmetics by university students and others.

Not to mention that contact lens use has become more popular nowadays. An old prospective study was conducted in King Saud University in Riyadh to estimate contact lens status in refractive errors correction. The study was concluded that, contact lenses constituted a minor proportion of refractive errors correction in compare to glasses, and they expected a greater tendency towards contact lenses and PRK in the future [13]. Although many studies have shown the effective use of contact lenses, there have been some studies observed fear of complications and cost as the confounding factor to avoid contact lens [14]. A cross-sectional study about pattern of use of contact lens among college students showed the reasons for using contact lens, comfort and convenience followed by cosmetic reasons, clear

and wider field of vision and sports, and finally keeping the eye power stable [15]. The practice of contact lens wear and care plays an important role in avoiding complications. It's important to study the effect of patients' compliance on their perception, awareness and behavior during contact lens use. Also, a survey was conducted by interviewing contact lens wearers among health care workers in a university hospital. Out of 201 contact lens wearers with an average age of 23.5 years, 55% did not consider themselves good wearers and that was mostly due to not performing adequate cleaning to contact lens or case and non-compliance with medical orientation [16]. Several Studies discussed types of contact lenses and their short-term and long-term complications. Results showed poor compliance among students. Many were unaware of proper care of contact lenses [14]. Even among educated users such as medical students there was an increase in risk of complications. Therefore, a need for more education to the consumers is desired [17].

This study aims to estimate the prevalence of refractive errors among female students in King Saud University and to explore the associated factors, which contribute towards progression of refractive errors. Also to determine and compare pattern of use of either contact lenses or glasses in relation to their perception, awareness and behavior between medical and non-medical female students.

Methods

An observational quantitative cross sectional study was carried out between December 2012 and April 2013, at the Female Academic Medical Center and Female Business College in King Saud University, Riyadh, Saudi Arabia. The study subjects were female students in third and fourth year of their undergraduate course from Medical and Business colleges of King Saud University. Considering a 50% prevalence of refractive errors (from the literature), width of

Table.2: Associated factors of refractive errors.

Factors	Refractive errors		Chi square value	p- value
	Yes	no		
College				
Medical	106(55.5)	67(43.5)	4.9	0.03
Non-medical	85(44.5)	87(56.5)		
Year of study				
Third year	109(57.1)	78(50.6)	1.41	0.23
Fourth year	82(42.9)	76(49.4)		
Family monthly income				
Less than 5,000sr	4(2.1)	3(1.9)	0.46	0.93
5,000sr to 10,000sr	21(11.0)	18(11.7)		
11,000sr to 20,000sr	54(28.3)	48(31.2)		
More than 20,000sr	112(58.6)	85(55.2)		
Exercise				
None	108(56.5)	84(4.5)	3.3	0.35
Daily	10(5.2)	12(7.8)		
2 days per week	45(23.6)	28(18.2)		
3 days per week	28(14.7)	30(19.5)		
Hours spent watching TV				
1 to 2 hours	129(67.5)	101(65.6)	4.3	0.12
3 to 5 hours	53(27.7)	37(24.0)		
More than 5 hours	9(4.7)	16(10.4)		
Distance between subject and TV				
1 meter	22(11.5)	26(16.9)	3.8	0.28
2 meters	85(44.5)	57(37.0)		
3 to 4 meters	77(40.3)	62(40.3)		
Other	7(3.7)	9(5.8)		
Hours spent on computer a day				
1 to 2 hours	25(13.0)	32(22.1)	7.6	0.02
2 to 3 hours	73(38.2)	41(26.6)		
More than 3 hours	93(48.7)	79(51.3)		
Hours reading/ studying a day				
<1 hour	5(2.6)	5(3.2)	0.26	0.79
1 to 2 hours	71(37.2)	58(37.7)		
3 to 5 hours	76(39.8)	58(37.7)		
More than 5 hours	39(20.4)	33(21.4)		

95% confidence interval (margin of error) as 5% and at 5% level of significance we need to have 320 subjects. Assuming 20% non-response, the sample size was increased to 400. A relevant self-administered electronic questionnaire sent by email to all students. The questionnaire included opened & closed format questions, leading questions and dichotomous questions were written based on the objectives of the study. The study variables are: college, year of study, family history and refractive errors. Where the outcome variables are: prevalence of

refractive errors, use of glasses and lenses wearers and its associated factors. The questionnaire was also translated to Arabic since Arabic is the primary language in Saudi Arabia. The Ethical consent was obtained from the study subjects at the beginning of the distributed questionnaires.

Data analysis

The data were entered and analyzed using SPSS 21.0 version statistical package. Descriptive

Table.3: Comparison of pattern of use and type of care towards the use of contact lenses between medical and non-medical subjects.

Questions	Medical No (%)	Non-medical no (%)	Chi square value	p-value
Using contact lenses longer than recommended period				
Yes	24(46.2)	28(53.8)	0.020	0.886
No	49(45.0)	60(55.0)		
Removing contact lenses before going to sleep				
Yes	64(44.1)	81(55.9)	2.334	0.311
No	2(40.0)	3(60.0)		
Sometimes	8(66.7)	4(33.3)		
Washing hands before handling the lenses				
Yes	58(46.8)	66(53.2)	0.681	0.711
No	5(50.0)	5(50.0)		
Sometimes	10(38.5)	16(61.5)		
Washing contact lenses				
Yes	48(46.2)	56(53.8)	1.713	0.425
No	17(45.9)	20(54.1)		
Sometimes	5(29.4)	12(70.6)		

statistics (mean, standard deviation and percentages) were used to describe the quantitative and categorical variables. Chi-square test was used to observe an association between categorical study and outcome variables. A p-value of ≤ 0.05 and 95% confidence intervals were used to report the statistically significance and precision of estimates.

Results

Out of 400 surveyed female students in medical and non-medical (business) colleges, 345 responded at a similar response rate in both colleges, 173 were medical and 172 were business students. The mean (sd.) of age was 20.79(0.977). The distribution of third and fourth year was (n=187, 54.2%) & (n=168, 45.9%). The prevalence of refractive errors in our study is 55.4% (191 out of 345) of which 106 (55.5%) are medical and 85(44.5%) are non-medical students. Within colleges, out of a total of 173 medical students 61.3% (n=106) have some type of refractive error, whereas 38.7% (n=67) of them do not. In the other hand, out of a total of 172 non-medical students 49.4% (n=85) have some type of refractive error, whereas 50.6% (n=87) of them do not. The p-value= 0.03 indicates a statistical significant

difference between category of student (medical and non-medical) and presence of refractive errors. That is higher proportion of a medical students are affected with some type of refractive error when compared with non-medical students. (Table.1)

It was observed that, there are three existing types of refractive errors, with a percentage of 53.1% (n=129), the most prevalent type of refractive error is nearsightedness, astigmatism coming after with a percentage of 31.3% (n=76) and least commonly farsightedness (n=38, 15.6%). In addition, it shows that most female students developed refractive errors during their school years between the age of 12 and 18 (n=85, 45%), while only 22.8% (n=43) developed it after the age of 18. The results showed that the students who developed refractive errors at age 18 and above were found to be 27 (62.8%) medical students, compared to 16(37.2%) of non-medical students. A p-value of >0.05 shows that type of college attended has no effect on the developing of refractive errors after the age of 18. However, family predisposition played a major role on the tendency of developing refractive errors showing that 132 out of 189 have familial predisposition to refractive errors (69.8%). In addition, our data shows no statistical significance in correction methods

Table.4: Comparison between medical and non-medical students regarding the complication of contact lenses use

Questions	Medical No (%)	Non-medical No (%)	Chi square value	p- value
Experience Eye problems				
Yes	37(42.5)	50(57.5)	0.604	0.437
No	36(48.6)	38(51.4)		
Burning when wearing/ removing contact lenses				
Yes	10(40.0)	15(60.0)	2.021	0.364
No	17(56.7)	13(43.3)		
Sometimes	45(43.3)	59(56.7)		
Redness when wearing/ removing contact lenses				
Yes	15(35.7)	27(64.3)	2.265	0.322
No	16(51.6)	15(48.4)		
Sometimes	42(47.7)	46(52.3)		
Tearing when wearing/ removing contact lenses				
Yes	27(40.9)	39(59.1)	0.887	0.642
No	15(48.4)	16(51.6)		
Sometimes	31(48.4)	33(51.6)		

used among medical and non-medical female students. However, we found that the most common method is wearing glasses (n=170), with a distribution of medical (58.2%) followed by contact lenses (n=96), and surgery (n=21) being the least used method of refractive errors correction among the study subjects. About 51 (53.1%) medical and 45(46.9%) non-medical students using contact lenses therapeutically, whereas 44 (51.8%) medical students are using for cosmetic purposes and 41 (48.2%) by non-medical students. There is no statistically significant difference in the purpose of using contact lenses between medical and non-medical students (p-value >0.05).

Association of study variables with refractive errors

Results show that there is a strong association between studying in medical school and having refractive errors (p-value= 0.03). More than half of the study subjects who have refractive errors are medical students (55.4%). However, family predisposition played a major role on the tendency of developing refractive errors showing that 132 out of 189 have familial predisposition to refractive errors (69.8%). Other associated factors were studied; year of study, family monthly income and exercise which showed no statistically significance (p-value>.05).It has been believed that the more hours spent reading, watching TV and using

computer the more chance of getting refractive errors, or for those who have refractive error already, it might get deteriorated. However, not all of these risk factors were statistically proven in the present study. The only statistical significance was observed is the relation between refractive errors and number of hours spent in front of computer screen (p-value = 0.05). (Table.2)

Comparison of Pattern of use and type of care towards the use of contact lenses between medical and non-medical subjects

The study subjects were asked 4 different questions related to type of care, and their responses indicates no significant difference in the pattern of use and type of care towards the use of contact lenses. About 45% (n=49) of medical students and 55% (n=60) of non-medical students were not using contact lenses longer than recommended period; and 44.1%(n=64) of medical students and 55.9%, (n=81) of non-medical were removing their contact lenses prior to sleeping at night; the majority of the students were adherent strictly to proper hygiene were (n=58, 46.8%) of medical students and (n=66, 53.2%) of non-medical cited washing their hands before handling the lenses, and when it comes to contact lenses, (n=48, 46.2%) of medical students and (n=56 , 53.8%) of non-medical cited yes. There is no significant difference

between the proportion of medical and non-medical students in the pattern of use and type of care towards the use of contact lenses (P-value= >0.05) (Table.3).

Comparison of complications of contact lens use between medical and non-medical

The study subjects were asked 4 questions about experiencing different types of complications of contact lens use. The first was if they have experienced any kind of eye problems, 42.5% of those responded yes were medical students, while 57.5% were non-medical students. The second question was if they have experienced any burning sensation when wearing/removing contact lenses, medical students made up 40% of that who answered yes, whereas 60% were non-medical. Third question was about noticing redness of eyes when wearing/removing contact lenses, the results showed that the majority of those who suffers from eye redness when wearing or removing contact lenses were non-medical students 64.3%. Meanwhile 35.7% of students who experienced this complication were medical students. Last question was about tearing when wearing/removing contact lenses, 59.1% of those who have experienced that were non-medical students and the 40.9% of them were found to be medical students. A p-value > .05 for all the 4 questions indicates type of education (medical and non-medical) had no effect on the occurrence of complications (Table.4).

For assessing the level of knowledge of the study subjects about refractive errors, we asked them whether uncorrected refractive errors cause blindness or not. Only 81 students out of 163 who answered the question got the correct answer, which is yes. Surprisingly, 69.1% of them are non-medical students.

Discussion

This study quantified the prevalence of refractive errors among the female students of

King Saud University, in which medical students were more affected than non-medical students, and, myopia (nearsightedness) being the most prevalent type of refractive error. Further, the majority of students who developed refractive errors at age 18 and above were found to be medical students. In the comparison of the pattern of contact lens and the levels of knowledge/awareness and care towards its use between the two groups, the vast majority of wearers adhere to the medical guidelines for wearing contact lenses. However, non-medical students showed more compliance with guidelines for wearing contact lenses in compare with medical students. In addition, the occurrence of eye complications in contact lens users is lesser among female Medical students. The most significant associated factors of refractive errors were hours spent setting in front of computer screen and genetic predisposition. Neither the socioeconomic status nor the time spent reading or watching TV revealed significant association.

A previous study estimated the prevalence of medical students who have refractive errors to be around one third [18]. Our study showed, that more than one half of the students have some type of refractive error. Out of the three types of refractive errors, myopia (nearsightedness) is found to be the most prevalent refractive error especially in medical students; this was also previously found from a cross-sectional descriptive study that was conducted among medical students in AIMST University in Malaysia and from a study conducted among male and female NRI medical students in south India.

The majority of students who developed refractive errors at age 18 and above were found to be medical students. 62.8% medical students compared to 22.8% non-medical students. This may be because medical students have more intense curriculum, which requires them to spend a lot of time on computers studying, and reading as to non-medical

students who only spend few hours a day studying. This supports our hypothesis, which states that the intensity of the learning process among Medical student leads to the development of refractive errors after the age of 18. The association between the year of the study and refractive errors was statistically insignificant in the present study. Whereas, a study conducted in Isfahan University revealed that the higher the level of a student in medical college, the higher the prevalence of refractive errors [6].

Given the fact that people whose parents have myopia may be more likely to get the condition [19], our results show that the vast majority of students with refractive error tend to have a family history of refractive error. Beside the genetic predisposition, several environmental risk factors for myopia, including higher educational attainment, higher socioeconomic status and increased amount of near-work activities, are well documented in children and adult populations. However, the exact mechanism of how these factors induce the development and progression of myopia remains controversial [21].

The present study has observed that, a higher proportion of female Medical students prefer to wear glasses as a correction method when compared with female Non-medical students. However, this difference in proportion is found to be not significant. The results show similarity to a previously multicenter randomized survey conducted between September 2010 and January 2011 to individuals who attended the eye hospital, optometry clinics, camps and also relatives and friends in and around Hyderabad, Andhra Pradesh, India. This study showed that 59.3% are wearing glasses, followed by contact lens as second choice and lastly refractive surgery.

In regard to contact lenses use, more than half of medical students who were surveyed reported using contact lenses for therapeutic purposes, which are in close agreement with

prior estimates, but surprisingly, the use of contact lenses for cosmetic purposes was reported in higher percentage among medical students in compare with non-medical students. Towards the levels of care towards the use of contact lenses in medical and non-medical female students our data shows that, the vast majority of wearers adhere to the medical guidelines for wearing contact lenses. However, non-medical students showed more compliance with guidelines for wearing contact lenses in compare with medical students that could be due to many reasons; they probably take less care of their health which might be related to time limit. Although, they should be more aware of complications related to taking lesser care, they underestimate simple things related to their health and focus on more complex and serious health problems. A study was done by Muhammad Muneer Quraishy about awareness of contact lens among medical students, proved that many students were unaware of proper care of contact lens and were ignorant of the potential of serious complication associated with contact lens use, whereas others who may be aware of complication are still not careful with the handling and wearing schedule of contact lenses [6], hence our study confirms the findings of this study's result.

Contact lenses use may cause some minor but bothersome side effects, and the cause of these problems may be because of poorly fitted lenses, poor care of the lenses or allergy to cleaning solutions. The side effects may include burning sensation when wearing/removing of the lenses was the majority of students who suffered from this side effect were non-medical students. Redness of the eyes which non-medical students suffered the most from and tearing when wearing/removing the lenses was also experienced more by non-medical students. These three complications are the commonest among contact lenses usage that's why we measured them. And this also, supports our hypothesis, which states that the occurrence of

eye complications in contact lens users is lesser among female Medical students.

The results of the study revealed significant relationship between being enrolled in medical school and having refractive errors, which supports the hypothesis states that the prevalence of refractive errors is higher amongst medical students. The reason behind this relationship that medical students study more intensively and they are more exposed to perform near-work activity than business college students do. Another statistical significant association was found between the hours spent setting in front of computer screen and having refractive errors, the prevalence of refractive errors is higher among those who spend longer hours using computers. Neither the socioeconomic status nor the time spent reading or watching TV revealed significant association. Furthermore, the influence of the level of physical activity on the development of refractive errors was studied in the present study, which showed no significant relation. In contrast, a lower incidence of myopia was documented in university students of Copenhagen who are physically active [4]. The amount of time engaged in sports was independently associated with myopia inversely. There have been concerns in many previous studies that refractive errors are one of the leading causes of blindness, especially if uncorrected. Blindness registry data indicates that myopia is the fourth leading cause of blindness in Singapore [20]. Also, a study of 112 adult myopic patients showed that patients with high myopia had significantly worse visual function, which might lead to blindness [20]. The knowledge of King Saud University female students was assessed by asking them about whether uncorrected refractive errors could cause blindness or not. Results were statistically significant, more than half of the students were aware about this. Surprisingly, the majority of those who guessed the correct answer were non-medical students.

Conclusions

The vast majority of participated female students in King Saud University have some type of refractive error; higher proportions of medical students were affected when compared with non-medical students. The most prevalent type of refractive error is near sightedness, astigmatism and least commonly farsightedness. When comparing pattern of contact lenses use, more than half of medical students reported using contact lenses for therapeutic purposes, but unpredictably for cosmetic purposes as well. The majority of wearers were adherent to the medical guidelines for wearing contact lenses. However, non-medical students surprisingly showed more compliance with guidelines for wearing contact lenses in compare with medical students. Several factors were studied and asked within the survey to detect the associated factors among them. As a result, we concluded that factors such as hours reading/studying a day, hours spent on computer a day, hours spent watching and distance between subject and TV were strongly associated with causing refractive errors. On the other hand, factors like year of study, major, and exercise were not related. In contrast, they were documented in similar studies as associated factors.

Recommendations

We believe that college students should be educated more about their health especially their eyes. Students who are at high risk (e.g. family history, exposed to near work) should be aware more about the problem and start preventive measures even before developing refractive errors. Awareness programs should be conducted that include: up to date types of correction and recommendations for users.

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The authors declare that there is no conflict of interest with the subject matter of the paper, nor any commercial or proprietary interest in any product or company.

Author's contribution

SSA: Conceived the study and prepared final manuscript for publication

MAA: Conducted the study, analyzed data and prepared draft manuscript.

AKH: Collected data, helped analyzing data and preparing manuscript.

AMO: Collected data, data entry, and helped analyzing data

DIF: Carried out literature search, prepared questionnaire and collected data.

DSM: Carried out literature search, prepared questionnaire and collected data.

MAH: Conducted the study, analyzed data and prepared draft manuscript.

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