

Research Article

Prevalence, progression and associations of corrected refractive errors: a cross-sectional study among students of a Medical College of Odisha, India

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Received: 12 August 2016

Accepted: 08 September 2016

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ABSTRACT

Background: WHO estimates that Refractive errors are a major cause of blindness in the world leading to 42% cases of visual impairment. Refractive errors are a significant issue among young adults; this study was conducted to find out the prevalence, progression and associations of refractive errors in medical students.

Methods: This was a cross-sectional study conducted among all the students of MKCG Medical College, Berhampur, Odisha, India.

Results: Out of the 506 subjects analysed, 47.4% used spectacles and 2.2% used contact lens. 48.8% of spectacle users and 81.8% of contact lens users were females and the rest males. The mean age of the sample was 22.52 years (SD=1.90). The mean age at which refractive error was diagnosed is 16.47 (SD=3.42) and the duration of corrected refractive errors was 5.90 years (SD=3.90). The most common refractive error prevalent was Myopia (54.5%) followed by combined myopia and astigmatism (31.3%), hypermetropia (8.6%) and astigmatism (5.6%). The corrected refractive error ranged from 0.25 to -12.5 D for Myopics and 0.25 to -2.5 D for Hypermetropia with a median correction of -1.75 D spherical, 0.00 D cylindrical in the right eye and the left eye alike. 73.3% of the subjects reported an increase in refractive errors since diagnosis. There was a significant increase in refractive error in myopia as compared to hypermetropia ($\chi^2=5.20$, $p=0.023$) and no difference between males and females ($p=0.91$). 26.7% respondents reported selective use of spectacles and 62.5% used bright light for reading purposes. Their most preferred activity during leisure time was mobile phone use (43.8%) followed by laptop/pc use (16.3%). 90% had at least 1 ophthalmological check up in the last 12 months. Significant difference was found among those with and without refractive errors in their Height ($p=0.026$), time spent reading per day ($p=0.001$). Significant positive correlation was reported between duration of spectacle use and the increase in dioptre power ($r=0.32$, $p<0.01$ for spherical and $r=0.24$, $p<0.01$ for cylindrical). No significant difference was found among the same regarding patterns of TV / PC/ Mobile phone use, sleep duration, age and weight of the respondents.

Conclusions: The high prevalence of spectacle use warrants further studies for establishing the pattern of change in refractive errors and behavioural habits.

Keywords: Myopia, Refractive errors, Spectacle use

INTRODUCTION

WHO estimates that Refractive errors are a major cause of blindness in the world leading to 42% cases of visual impairment.¹ 27.1 million persons in the 16-39 year age

group suffer from visual impairment due to refractive errors.² Refractive errors occur when the shape of the eye prevents light from directly focussing on the retina.³ Myopia and hyperopia are the types of refractive error in which the optical system of the eye brings light into focus

anterior and posterior to the fovea, respectively, resulting in blurred vision. Blurred vision from refractive error can be relieved usually by spectacles, contact lenses, or Refractive surgery. Nevertheless, the high prevalence of refractive errors and the costs of refractive correction make these conditions a substantial public health and economic problem, especially in low-middle income countries.

Various studies in Asian population demonstrate a rise in refractive error (RE) among school and college students in epidemic proportions. Studies in Singapore and Taiwan have shown a prevalence of more than 80% among medical students.^{4,5} Studies among Indian school children show a prevalence of refractive errors of around 25% which increases to more than 40% in adulthood.^{6,7} However, studies among Indian medical students are lacking. Hence this study was conducted with the following objectives:

- To estimate the prevalence of corrected refractive errors in Medical students of MKCG Medical College.
- To know the progression of CRE.
- To analyse the associations of CRE with near work activities.

METHODS

This was a cross sectional observational study conducted at MKCG Medical College, Berhampur among MBBS undergraduate Students of the college during August, 2015. There were 598 students enrolled in all the undergraduate batches. All of them were approached for participating in the study.

IEC approval was obtained and data was collected using personal interviews and a pre-designed and pre-tested questionnaire was used as the study instrument. A pilot study was conducted among 20 students and necessary modifications were made to the final questionnaire. Students were interviewed in the college after their classes with prior intimation. Verbal consent was

obtained from all the willing students. Everyone was requested to bring their ophthalmic prescriptions if available. Interviews were conducted for absentee students in their hostel rooms the questionnaire had 3 parts:

Part-1 recorded the socio-demographics and bio-physical measurements of the subjects; Part-2 had questions on their Habits and behaviors and Part-3 recorded the refractive errors history and current Corrected refractive error (C.R.E.) status. Ophthalmic prescription was used to record the C.R.E. status of the subjects, wherever available.

“Reading under Bright light” was defined for this study as situations consisting reading with at least one of the following: 1. Reading under a table lamp; 2. Two or more Tube lights/CFL/LEDs in the room; 3. Reading with natural light during daytime with door/windows open. “Reading under Moderate light” was classified as either of the following situations: 1. one tube light in room; 2. One CFL/LED lamp in room; 3. Reading with artificial light during daytime with doors/windows closed. Situations not meeting the above criteria were classified as “Reading under dim light”.

Statistical analysis

Statistical analysis of the data was done at the Department of Community Medicine, MKCG Medical College, Berhampur, using the open source software GNU PSPP ver. 0.9.0. Univariate analysis was done where Chi-Square test and t-test were used as the tests of significance. Linear association was measured using correlation techniques. All analysis was done at the level of significance of 0.05 and 95% confidence intervals.

RESULTS

Out of the 598 undergraduate students, 506 participated in the study, with a response rate of 84.6%. Of them, 59.5% (n=301) were males and 40.5% (n=205) were females.

Table 1: Prevalence and distribution of corrected refractive errors.

Sex	Corrected refractive errors			Total
	Present		Absent	
	Spectacles	Contact lens	-	
Male	123 (40.9%)	2 (0.7%)	176 (58.6%)	301
Female	117 (57.1%)	9 (4.4%)	79 (38.5%)	205
Overall	240 (47.4%)	11 (2.2%)	255 (50.4%)	506

The mean age was 22.5 years (range: 18-28 years). The age distribution for males and females was similar ($\mu=22.75$ for males and $\mu=22.18$ for females). The

prevalence of Corrected Refractive Errors was 49.6%. Prevalence of CRE is significantly more in females as compared to males ($P\leq 0.01$). The distribution of CRE is

given in Table 1. Females had significantly higher use of Contact lens as compared to males with OR=4.73 (95% CI=1.00-22.355; p=0.03). 74.1% (n=186) of those with CRE had a family history of RE in any of the parent. This was 43.6% (n=111) in those without CRE.

The most common refractive error prevalent was Myopia followed by Combined Myopia and Astigmatism. The distribution is given in Table 2.

Of the total myopics, 7% had pathological myopia defined as RE of >6D and the rest 93% were having Physiological myopia.

Table 2: Prevalence and type of refractive errors.

Refractive error type	Prevalence	Range
Myopia	54.5%	-0.25 to -12.5 D
Combined myopia and astigmatism	31.3%	
Hypermetropia	8.6%	+0.25 to +2.5 D
Astigmatism	5.6%	-0.25 to -3.0 D

The mean duration of use of Spectacle/CL use was 5.90 (±3.90) years. Males had CRE for a significantly greater duration than females (P=0.003). The distribution is given in Table 2.

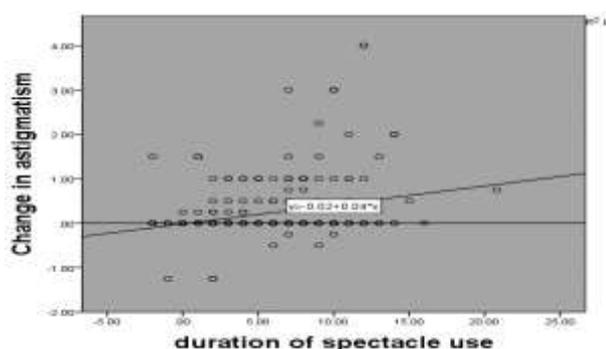


Figure 1: Relationship between duration of spectacle use and change in cylindrical power.

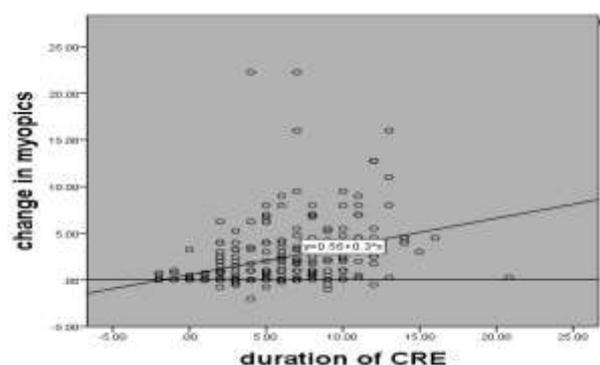


Figure 2: Relationship between duration of corrected refractive errors and change in spherical power.

Significant positive correlation was reported between duration of spectacle use and the increase in dioptric power. This was greater for spherical correction (Pearson's r=0.32; p<0.01) as compared to cylindrical (Pearson's r=0.24; p≤0.01) (Figure 1 and 2).

Table 3: Age of diagnosis and duration of SPEC/CL use.

Sex	Age of RE diagnosis (in years)	Duration of Spec/CL use (in years)
Male	16.10 (±3.41)	6.63 (±3.98)
Female	16.83 (±3.42)	5.18 (±3.70)
Overall	16.47 (±3.42)	5.90 (±3.90)

73.3% of the subjects reported an increase in refractive errors (any type) since diagnosis. There was a significant increase in refractive error of myopics as compared to Astigmatism ($\chi^2=5.20$, p=0.023) (Table 4).

Table 4: Vector of change of refractive errors.

Vector of change	Myopia	Astigmatism
No change	28.3%	74.9%
Decrease	4%	2.8%
Increase	67.6%	22.3%

The most preferred leisure activity in the study subjects was Mobile phone use. A higher number of subjects without glasses preferred sports and subjects with glasses preferred reading.

Table 5: Distribution of most preferred leisure time activity.

Activity most preferred	Without Spec/CL	With Spec/CL
Mobile use	36.5%	43.8%
Laptop-PC	16.1%	16.3%
Outings	15.3%	15.5%
Sports	19.6%	6.8%
TV	9.8%	7.2%
Reading	2.7%	10.4%

No significant association was found between spectacle users and most of the study variables. The average height of students with CRE was significantly more than those without CRE (Table 6).

73.31% subjects used their Spectacles/CL all of their awake time and the rest 26.69% used them selectively while watching TV/ Reading etc. There was no association between increase in CRE and constant use of spectacles.

62.5%, 32.6% and 2.9% of the subjects used Bright, Moderate and dim light for reading purpose respectively. There was no statistically significant association between

type of light used and presence or absence of CRE and vector of change in CRE. Overall, 40.7% subjects had 1 Ophthalmological check up in the past 12 months. But

90% of those with CRE had at least 1 eye check up in the last 12 months.

Table 6: Possible associations of spectacle use.

Variables	With Spec/CL (μ)	Without Spec/CL (μ)	p-value
Time spent per day watching TV	1.35 hours	1.38 hours	0.88
Time spent per day watching PC	1.89 hours	1.64 hours	0.14
Time spent per day using mobile (other than calling)	3.30 hours	2.90 hours	0.09
Sleep per day	7.13 hours	7.01 hours	0.34
Height	1.63 m	1.60 m	0.02
BMI	24.99	25.57	0.08

DISCUSSION

The prevalence of Corrected refractive errors in this study was 49.6%. This was less than similar studies conducted in other Asian countries. Studies by Woo et al in Singapore and Lin et al in Taiwan reported a very high prevalence of 89.8% and 92.8% respectively.^{4,5} Studies in Caucasian population reported a lower prevalence of around 33%.⁸ Similar study in Indian Medical students of Gujrat reported comparable results of 55.6%.⁹ These variations may be attributed to different genetic composition and height of the study populations.^{10,11} High prevalence of refractive errors in medical students may be due to the intensive and long near work habits such as reading and writing that are involved in medical studies.¹²

Prevalence is significantly more in females (61.5%) than male students (41.6). Similar results were seen in separate studies specific to medical students by S.Gopalakrishnan et al and Woo et al in Singapore.^{13,14} However these findings were in contrast to findings of population based studies by Shimizu et al in Japan and Dandona et al in Andhra Pradesh, India, where the prevalence of refractive errors was greater in males.^{14,15}

Females had significantly greater use of Contact lens than males. (OR=4.73; 95% CI=1.00-22.355; p=0.03). This may, in part, be attributed to the cosmetic benefits of contact lenses over glasses. Market research on consumer trends show similar deviations.¹⁶ 74.1% students with CRE had at least one parent with RE. Children of myopic parents tend to have longer eyes, even before developing myopia, hence leading to refractive errors.^{17,18} A study among medical students of turkey showed a significant OR of 3.69 (95% CI=1.98-6.87) for developing RE in those with parenteral history of RE.⁸

Most common type of CRE prevalent was Myopia (54.5%) followed by combined Myopia and Astigmatism (31.3%) This is in concurrence with Asian and Indian populations for the same age group.^{4,15} Prevalence of

pathological Myopia was 7%. This was higher than that reported in population based studies in Tamil Nadu (3.71%) and USA (4.5%), Western Europe (4.6%) and Australia (2.8%). Mean duration of CRE was 5.9 years. This was greater in males possible due to earlier onset of RE in them. Mean age of diagnosis was 16.1 years in males and 16.83 years in females.

73.3% reported an increase in CRE. Power of RE correction increased with duration of CRE. This was greater in Myopia than Astigmatism. Similar progression in RE was observed by Kathoria et al.⁹ 19.6% students without CRE indicated Sports to be their most preferred leisure activity but only 6.8% of students with CRE preferred sports. Use of corrective lenses may lead to inconvenience during outdoor activities like sports and cause a decreased preference for the same.

New generation gadgets have replaced reading as the most prevalent near work activity in recent times. There was no significant difference between subjects with and without CRE regarding the Near vision activities like watching PC, TV, mobile use etc. This was in contrast to other studies where a significant difference was suggested between persons with and without RE regarding near work activities.^{9,19,20} Significant difference was found between the height of those with CRE (mean=1.63m) and without CRE (Mean=1.60m); (p=0.02). Increased height is associated with increase length of eyeballs which may contribute to myopia.⁹ Such association of height with myopia has been seen by Seing-Mei et al in Chinese children and by Teasdale et al in Danish adults.^{11,20} 90% of those with CRE had at least one ophthalmological check up in the last 12 months. This indicates good awareness regarding regular follow up for RE corrections.

CONCLUSION

In the present study, 47.4% used spectacles and 2.2% used contact lens. Significantly more number of females

used contact lens. The mean age at which refractive error was diagnosed is 16.47. The most common refractive error prevalent was Myopia followed by Combined Myopia and Astigmatism. Since diagnosis 73.3% of the subjects reported an increase in refractive errors. No significant difference was found regarding change in RE regarding patterns of TV / PC/ Mobile phone use, sleep duration.

Thus based on our observations of this study, we recommend the following:

- School eye screening programmes should be strengthened as the mean age of diagnosis is around 16 years.
- RE tends to increase in most cases and hence regular Eye test is to be encouraged.
- There is insufficient evidence to link RE progression with Mobile/PC/TV use and this common misconception among the general public needs to be addressed.

Limitations

As the sample is limited to medical students who tend to be more technically aware in matters of eye care, the findings cannot be generalized to young adults of the general population.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Kshatri JS, Panda M, Tripathy RM. Prevalence, progression and associations of corrected refractive errors: a cross-sectional study among students of a Medical College of Odisha, India. Int J Community Med Public Health 2016;3:2916-20.