Original Research Article

The association between near work and ametropia in a population-based study

ABSTRACT

Aim: To explore the prevalence and pattern of refractive errors among medical students in Calabar, Nigeria.
Study design: Prospective
Place and duration of study: Department of Ophthalmology, University of Calabar Teaching Hospital, Calabar, Cross river State, Nigeria, between April 2010 and July 2010.
Methodology: It was a prospective study. The sample population consisted of 83 year five clinical medical students. Subjects had cycloplegic auto refraction with Topcon autorefractor over four months to span the period the entire class rotated through ophthalmology department of the University of Calabar Teaching Hospital. A spherical equivalents (SE) ≥ +0.5D were determined as hyperopia; SE of ≥-0.5D myopia and ≥-0.50D cylinder as astigmatism. Statistical Package for Social Sciences version 20.0 was the tool for data analysis.
Results: Sixty-six (79.5%) of subjects showed a form of refractive error; 63.6%%, 16.7% and 19.7% were myope, hyperope or simple astigmat, respectively. The prevalence of ametropia was 82% in female and 78% in males. Statistical analysis was not significantly different between female and male medical students (*P* = .35, 95% Confidence Interval [CI], 0.31-0.40). Minus spherical errors ranged from -0.16 to -5.25 diopters and plus spherical errors ranged from +0.25 to +1.00 diopters, spherical equivalent between -0.25 diopters [D] and -2.75D) being the most common type (85.5%). Eight (9.6%) were wearing glasses at the time of the study agreeing with 10 (12%) who had eye pains while reading.
Conclusion: The prevalence of refractive errors among the sampled Nigerian medical students was slightly lower than those of Asian populations but higher than their Caucasian counterparts.

Key Words: *Medical students, Myopia, Near-work, Refractive error.*

INTRODUCTION

Myopia was first introduced as a refractive error to the scientific world by Kepler in 1611[1]. He also stated, for the very first time, that near-work and adaptation was the probable cause of myopia[2]. The exact pathogenic mechanisms of the myopisation of ocular refractive apparatus by near-work are yet to be fully agreed upon. Prolonged near-work was thought to lead to progressive myopia through the direct physical effect of prolonged accumulation. But according to current theory prolonged near work leads to myopia via the blurred retinal image that occurs during near focus. This retinal blur initiates a biochemical process in the retina to stimulate biochemical and structural changes in the sclera and choroid that lead to axial elongation[3] .

There is a growing concern regarding a correlation between refractive errors and near-work. But there is little information on the influence of near-work activities on refractive errors in our environment. Studies on refractive errors have focused on prevalence and glasses use pattern among primary and secondary school children in Nigeria and other parts of Africa[4-6]. Little is known about the role of reading in the distribution of different types of refractive errors in our African settings. Therefore, we examined the correlation of potential risk factor such as reading with ametropia among clinical medical students who have been involved in sustained near-work activities for about 5 years. This prospective study explored the prevalence and pattern of refractive errors among these students.

MATERIALS AND METHODS

Study involved year 5 clinical medical students (MBBS course) from the University of Calabar Medical School. Students went through ophthalmology posting in 4 groups of about 20 students in each group. Each group stayed in the department for 1 month. All participants accented to informed consent and study's protocols which were in keeping with the tenets of Helsinki declaration. Students were assessed for refractive errors at ophthalmology department of the University of Calabar Teaching Hospital using stand-alone TOPCON RM-8000B (TOPCON Corporation, Tokyo, JAPAN) auto-refractometer.

Cycloplegia was achieved by a short acting cycloplegic tropicamide 0.5% three times at 5 minutes interval. A short acting cycloplegic agent was deliberately chosen to allow for resumption of near activities as soon as possible. Students who were dilated where used as 'guinea pigs' by their colleagues to learn direct funduscopy for that day. Another batch took turns the days ahead. Average of three readings were recorded for each eye. Additional demographical data was obtained via a proforma filled by the students. The duration of the data collection was 4 months when the 4 groups had rotated through our department. Spherical equivalents were calculated by the addition of half of cylinder powers to the spheres.

Refractive error was diagnosed if spherical equivalent was $\pm$0.50 or greater or a sphere/cylinder of $\pm$0.50 diopters or greater in the right eye. Those errors which required only cylindrical correction were considered as simple astigmatism which were in minus cylinder forms. Myopic errors less than – 6.0 D were considered as low myopia and those equal to – 6.0 or more were considered as high myopia. Prevalence of refractive errors was determined by finding the average of students who had refractive errors against the total numbers of students in the class multiplied by 100. Astigmatism was considered with-the-rule (WTR) if the plus cylinder acts at 90^0 meridian or at 20^0 on its either side or against-the-rule (ATR) if the plus cylinder acts at 180^0 meridian or 20^0 on its either side. Outside this range (20^0 to 70^0 and 100^0 to 160^0), the astigmatism was considered oblique.

For all analyses, cycloplegic autorefraction data of the right eyes were considered. However, data from both eyes were tabulated side by side for ease of comparison. Statistical analysis was performed using SPSS (SPSS 20.0 for Windows; Chicago, IL). Univariate analyses utilized chi-square test or Fischer Exact Probability test were used to compare proportions. Factors related to both eyes were entered into a multivariate logistic regression analysis. With 95% confidence interval (CI), a two-tailed P value of less than 0.05 was considered statistically significant.

RESULT

A total of 83 students {55 (66.3%) boys and 28 (33.7%) girls}, age between 20 to 34 years (25.5 ± 3.3) were included in the study. Sixty-six (79.5%) (95% CI, 75.3% to 82.50%) subjects who met the pre-determined criteria were designated to have a form of refractive error in which 42 (63.6%), 11 (16.7%) and 13 (19.7%) of students were myope, hyperope or simple astigmat, respectively. Of those with ametropia, 43 (65.2%) were males and 23 (34.8%) were females. The prevalence of ametropia was 82% in female and 78% in males. Statistical analysis was not significantly different between female and male medical students (p = 0.35, 95% CI, 0.34-0.36).

Anisometropia (difference in spherical equivalent of 2.0D or more) was not recorded. Minus spherical errors ranged from -0.16 to -5.25 diopters and plus spherical errors ranged from +0.25 to +1.00 diopters, spherical equivalent between -0.25 diopters [D] and -2.75D) being the most common type (85.5%). The mean spherical equivalent in the whole group was -0.95 ± 1.2 D (right eye), -0.79 ± 1.0 D (left eye) and -0.87 ± 1.1 D (both eyes). This was statistically significant (p = 0.017, CI, 0.015-0.020 by Fischer's Exact Probability Test). After adjusting for age and sex in a multivariate linear regression, the difference between the eyes became inconsequential, p = 0.50 (right eye) and p = 0.41 (left eye). There was no student with high myopia.

Table 1 and Figure 1 give the vision status and age distribution respectively. Figure 2 shows reasons students were not using glasses. Only 16 (19.6%) had worn glasses before while 67 (80.7%) had not

worn glasses before. Seventy-five (90.4%) were not wearing glasses at the time of the study, 8 (9.6%) were wearing glasses at the time of the study. Seventy-nine (95.2%) will use glasses if there was need for them. Ten (12%) had eye pains while reading. Fifty-nine (71.1%) had at least a family member using glasses. Table 2 shows the pattern of refractive errors seen in the students.

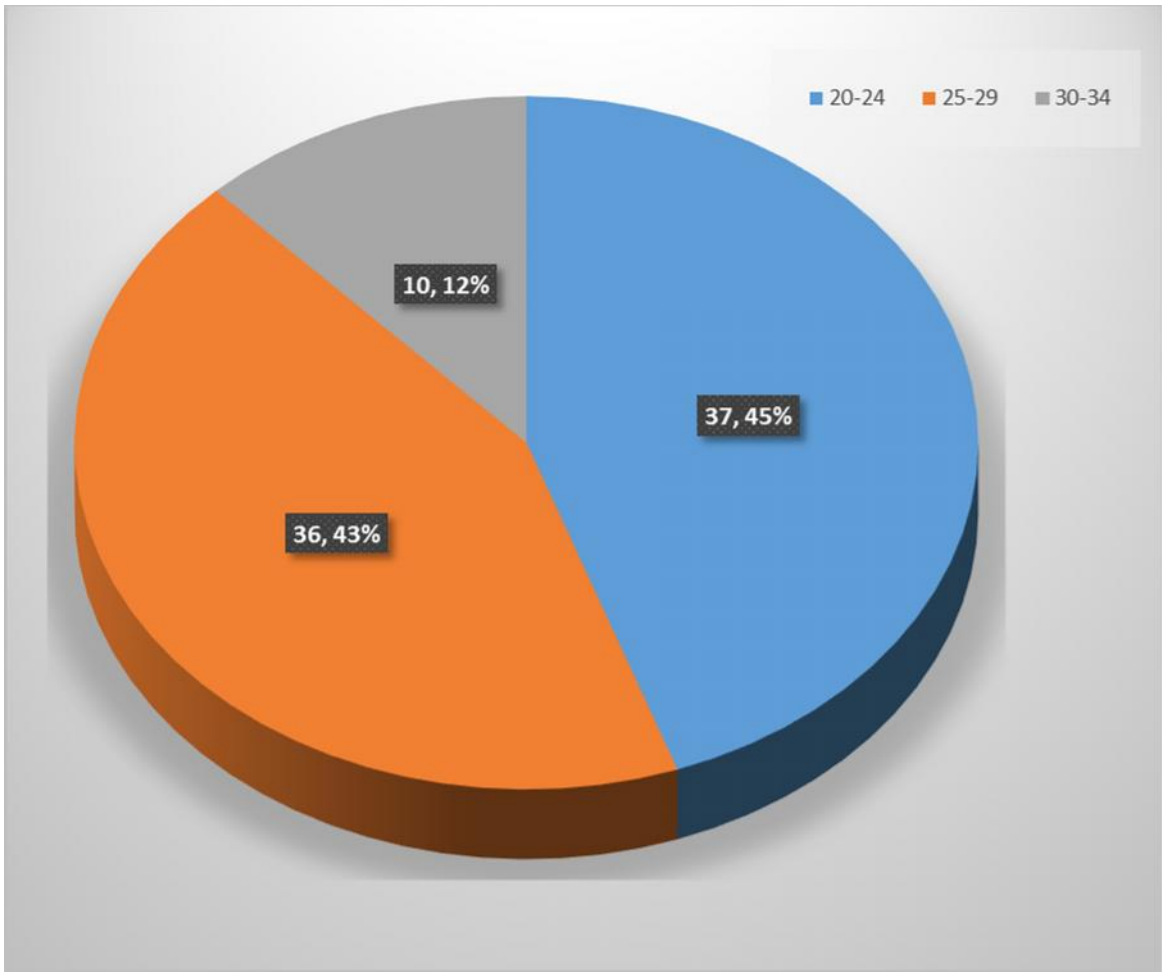

Figure 1: Age distribution

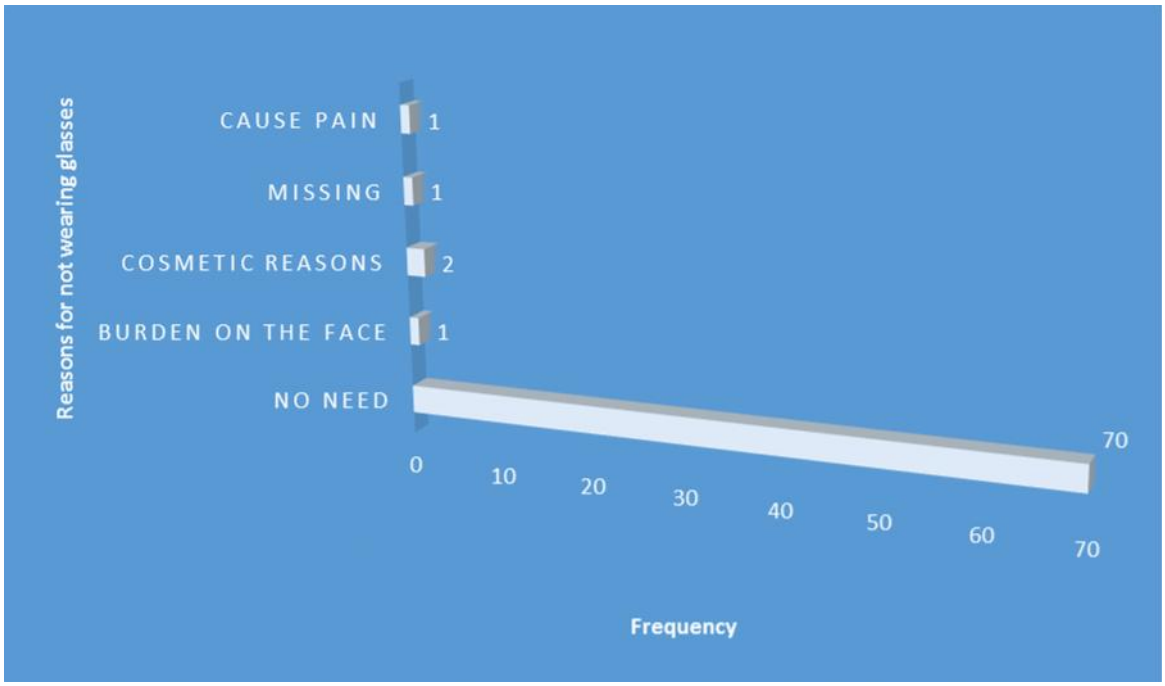

Figure 2: Reasons for non-use of refractive spectacles

131 **Table 1: Visual acuity**

	RIGHT EYE	LEFT EYE
VISUAL ACUITY	**Frequency (%)**	**Frequency (%)**
≥6/18	79 (95.2)	78 (94)
<6/18-6/60	2 (2.4)	2 (2.4)
<6/60-3/60	1 (1.2)	2 (2.4)
<3/60-NPL	1 (1.2)	1(1.2)
TOTAL	83 (100)	83 (100)

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133 **Table 2: Pattern of refractive errors**

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Spheres(diopters)		
	Right eye (%)	**Left eye (%)**
+1.25 to +0.25	16 (19.3)	19 (22.9)
<+0.25	0 (0)	1 (1.2)
plano	12 (14.5)	14 (16.9)
<-0.25	1 (1.2)	0 (0)
-0.25 to <-1.25	33 (39.8)	27 (32.5)
-1.25 to <-2.25	12 (14.5)	16 (19.3)
-2.25 to <-3.25	5 (6.0)	2 (2.4)
-3.25 to <-4.25	2 (2.4)	4 (4.8)
-4.25 to < -5.25	1 (1.2)	0 (0)
-5.25 to <-6.25	1 (1.2)	0 (0)
TOTAL	**83 (100)**	**83 (100)**
Cylinders(diopter cylinder)		
+1.00 to +0.25	0 (0)	0 (0)
<+0.25	0 (0)	0 (0)
None	11 (13.3)	15 (18.1)
<-0.25	2 (2.4)	1 (1.2)
-0.25 to <-1.25	59 (71.1)	57 (68.7)
-1.25 to <-2.25	10 (12.0)	10 (12.0)
-2.25 to <-3.25	0 (0)	0 (0)
-3.25 to <-4.25	1 (1.2)	0 (0)
TOTAL	**83 (100)**	**83 (100)**
Spherical equivalents(diopters)		
+1.00 to +0.25	2 (2.8)	5 (7.4)
<+0.25	0 (0)	1 (1.5)
plano	3 (4.2)	5 (7.4)
<-0.25	8 (11.1)	3 (4.4)
-0.25 to <-1.25	33 (45.8)	34 (50.0)
-1.25 to <-2.25	16 (22.2)	10 (14.7)
-2.25 to <-3.25	5 (6.9)	5 (7.4)
-3.25 to <-4.25	3 (4.2)	3 (4.4)
-4.25 to <-5.25	1 (1.4)	1 (1.5)
-5.25 to <-6.25	1 (1.4)	1 (1.5)
TOTAL	**72 (100)**	**68(100)**
Types of astigmatism		
With-the-rule (WTR)	18 (25.0)	15 (22.1)
Against-the-rule (ATR)	29 (40.3)	28 (41.2)
Oblique	25 (34.7)	24 (35.3)
TOTAL	**72 (100)**	**68 (100)**

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DISCUSSION

Overall prevalence of ametropia in our study was 79.5%, myopia being the most common type (63.6%). Reports on prevalence of myopia in medical students in Asian countries showed higher rates of 82 and 89.8% in Singapore[7, 8], 92.8% in Taiwan[9], and 87.6% in Malaysia[10]. In contrast, similar studies on medical students in Norway, Denmark and Turkey yielded relatively lower prevalence rates of 50.3%, 50%, and 32.9% respectively[11-13]. Consistently high prevalence rates of myopia have been reported among medical students across several studies in many countries[14-17]. Reasons adduced to this included high level of educational attainment[18], above average intelligence[19], long and intensive study regimen[8], and prolonged near-work[7-10]. Medical and law students are a group of young adults who spend prolonged periods on reading and close work. With their intensive study regimen that spans on the average 5 to 6 years, they have been reported to be at high risk for myopia[7-12].

The afore-mentioned Singaporean studies[7, 8] carried out among medical student population reported significantly lower prevalence of hypermetropia (1.3%) than our study. While several studies have linked myopia with excessive near-work, much is yet to be learnt on the effects of near-work and hypermetropia. The risk factors for ametropia may be interrelated and statistical adjustment may not explain or completely remove the influence of other risk factors such environmental risk factor and pervasive influence of genetics. A previous study[10] based in Malaysia among medical student population has examined the prevalence of myopia with respect to ethnicity and reported myopia in 93% of Chinese ametropes than in Indian students (82% of Indian ametropes). In that study, near-work alone could not explain the disparities found in Chinese and Indian students. This fact may buttress the discordance in prevalence figures in the current and the above studies among Asians and Caucasians[7-13]. It seems reasonable to assert that the pattern of refractive errors and its severity appear multifactorial and polygenic (genetic and racial traits), while near-work plays a significant myopiagenic effect.

Despite extensive literature search of major data-bases, there is paucity of studies on refractive errors among African University students with which to compare our study. Nonetheless, the results of this study show a greater prevalence of refractive errors and myopia than would be expected in a general population in African settings. Epidemiological studies among African school children have reported refractive errors prevalence that ranges from 5.6%-13.5%, myopia (range, 4.3%-7%) being the commonest refractive error[5, 20, 21]. The mean ages of these African studies are much lower than that recorded in the current study. But the differences in age alone cannot account for the huge discrepancy in refractive errors and myopia prevalence. Indeed Framingham Offspring Eye Study[22] found the prevalence of myopia to decrease with age in 1585 offspring of 1319 parents. This is expected on account of decreasing growth of the eye after high school. The alarming prevalent figures recorded in our cohorts perhaps hinge on the extensive near-work by these medical students, considering the relative similarities, in terms of genetics and other environmental factors, between our study and afore-mentioned African studies.

Despite a slight female preponderance, statistical analysis of our data revealed no significant relationship between sex distribution and refractive errors. This is similar to previous studies among medical students[12, 13] and engineering students[23]. This also correlates with a Greek study which though reported a higher prevalence rate of myopia in female, showed no overall statistical significance[24]. The role of gender on refractive errors is inconclusive[25, 26]. It can be assumed that since growth spot appears much earlier in girls, the eye tends to attain longer axial length and consequently higher axial myopia. Post-pubertal periods, boys catch up and ocular measurements in both sexes then even out.

ATR was the commonest astigmatism in our study. This is in consonance with the findings that the prevalence of ATR astigmatism significantly increases with age, and WTR astigmatism significantly decreases with age, age 9 years being suggested by Lian-Hong et al as critical for the changes[27-30] The mean age of our study was 25.5 ± 3.3 meaning the critical age of WTR has been exceeded. The glasses acceptance rate in this study paralleled the numbers that had eye pains while reading. This lays credence to a study in Benin-City, South-South Nigeria among 500 University students by Ebeigbe et al [31] that undergraduates would use refractive spectacle if prescribed by doctors.

CONCLUSION:

Multiple conceivable confounding variables such as ethnicity, culture, nutrition, socioeconomic status et cetra may have inadvertently influenced the outcome of this study as earlier acknowledged. Nonetheless, this study showed that myopia was the predominant refractive error detected among medical students in our cohort. It also showed that the occurrence of myopia was higher among Asian medical students. Longitudinal studies are required to be done among students involved in prolonged reading to confirm the late onset of myopia and its progression during the course of study as compared to other students. Additionally, studies incorporating formal epidemiologic methods of analysis will address adequately the exact contributions of near work such as excessive reading in a myopiagenic environment and at the same time determine "reading dose" or specific near-work types that are myopiagenic.

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CONSENT

All subjects gave their informed consent

COMPETING INTEREST

Authors have declared that no competing interests exist.

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