American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS)
ISSN (Print) 2313-4410, ISSN (Online) 2313-4402

http://asrjetsjournal.org/

Prevalence of Eye Defects among Medical Students in Dominica

Otohinoyi David Adeiza[a], D'Souza Ryan Alex Francis[b], Igberi Ugochi Calista[c], Akanbi Hameed Ayotunde[d], Moheem Masumali Halari[e], Chidambra Dhariwal Halari[f*]

[a,b,c,d]*Medical Student, All Saints University School of Medicine, Hillsborough Street, P.o.box 1679, Roseau, Dominica.*

[e,f]*Assistant Professor, All Saints University School of Medicine, Hillsborough Street, P.o.box 1679, Roseau, Dominica.*

[f]*Email: drchidambra@gmail.com*

Abstract

The rate of visual impairment has been on a steady increase with several implicating factors. This has led to a more detailed attention in the trend of occurrence of visual defects and diagnosis. Among several reports, it has been recorded that medical students tend to have the most reported visual defects among other professions. Medical schools at Singapore, Taiwan, Denmark and Norway showed prevalence of eye defects among their students at the rate of 89.8%, 90%, 50% and 50.3% respectively. This study therefore aimed at recognizing the prevalence of common eye defects such as myopia, hypermetropia, colour blindness (daltonism) and astigmatism as well as identifying various factors responsible for the occurrence of these visual defects. A total of 200 medical students (aged 14 to above 40 years) in Dominica were examined. Refractive error and colour blindness were checked by using standard rudimentary tests. Additional demographical data was obtained through self-administered questionnaire. Among the students tested, 49.5% presented with at least one eye defect. Prevalence of myopia, hypermetropia, colour blindness and astigmatism were 61 (30.5%), 24 (12.0%), 6 (3.0%) and 67 (33.5%) respectively. The occurrence of eye defects among medical student tend to be alarming and student awareness scheme should be structured to help contain more cases of eye defect among medical students.

---

*Corresponding author.

Keywords: Eye Defects; Eye Diseases; Prevalence; Ophthalmology; Myopia; Hypermetropia; Astigmatism; Color Blindness; Medical Students; Medical Education; All Saints University School of Medicine; Dominica.

1. Introduction

The human eye plays a vital role in human existence as it functions to provide sight and proper coordination in various tasks. Its functionality is mediated by the optic nerve (cranial nerve 2) which originates at the level of the optic chiasma, which is from the decussate of each retina's nasal half and extends to the visual cortex of the occipital lobe [1,2]. Insult to any part of the optic nerve usually result in poor vision, dyschromatopsia (colour blindness), diminished sensitivity to bright light, poor contrast sensitivity, defective afferent pupillary and visual field defect. Though, colour blindness tends to show early indicator of optic nerve neuropathy in most cases [1]. Commonest visual defects are usually attributed to defective refractive index such as in the cases of myopia, hypermetropia and astigmatism with fewer cases of color blindness [3].

A healthy eye possesses the ability to provide clear vision for objects that subtend three minutes of the arc at 6.10m (20ft) from the viewer, thus classifying the vision as 20/20 [4]. The numerator defines the distance amid the viewer and the focus and the denominator defines the distance of an average individual for similar quality of vision [5]. Myopia (nearsightedness) is the most common eye defect pertaining to refractive index. It occurs when parallel light focuses in front of the retina due to elongated eyeballs, thus making only near objects to focus on the retina. It is usually corrected by diverging lens with a specific focal length equal to the far point distance [6]. On the other hand, hypermetropia (farsightedness) occurs when the eyeball is shortened (similar in cases of presbyopia) making parallel light focus behind the retina. It is corrected by converging lens, thus rectifying the 25cm increase of near distant focus [7]. Astigmatism involves the development of distorted images on the retina due to uneven curvature of the cornea. This is mostly fixed by a cylindrical lens [8].

With limited explanation for eye defects, prevalence of reported cases tend to be rising. Based on World Health Organization (WHO) estimates, 153 million people live on the globe with visual impairment due to uncorrected refractive errors, with 8 million blind and 12.8 million in age group of 5-15 years [9]. Other studies reveal that 2.3 billion people worldwide suffer from refractive errors with only 1.8 billion having access to affordable repair [10]. About 5 thousand people in Latin America and the Caribbean were reported blind while 20 thousand complained of vision impairment during a survey [11].

Among several factors linked with ocular disease such as age, family history and lifestyle, the use of electronic devices has also been accepted as a predisposing cause of poor eye sight. A survey showed that virtually all institutions, universities, colleges, agencies and homes regularly use electronic gadgets for various day-to-day activities [12]. A computer use of 3 hours daily have also been observed to cause computer vision syndrome [13]. Since the university level can be classified as the highest institution of learning, the demand on students to spend more time on the screen tends to be higher especially with medical students due to their heavy work load [10]. Reports have shown that eye defects among medical students tend to be on the increase [11]. Studies revealed that prevalence of eye defects among medical students in Singapore, Taiwan, Denmark and Norway were 89.8%, 90%, 50% and 50.3% respectively [14]. However, less has been done to study the prevalence of

major eye defects among medical students in the Caribbean as well as careful assessment of the factors which contribute to the visual impairment. This research work does not only explicitly assess the common eye defects which include myopia, hypermetropia, astigmatism and color blindness but also focus on likely contributory factors to the visual defects among the medical students in an institution in the Caribbean.

2. Materials and Methods

The research was a cross-sectional study involving two modes of data collection (administration of questionnaire and eye examination), carried out at All Saints University, School of Medicine located at the Commonwealth of Dominica, in the month of November, 2015. A total of two hundred medical students willingly participated in the study with an average of twenty students from each class; a representative number of the student population in the school. Eight students were excluded from the study as they did not possess their visual aid during the study.

Written and signed consent were obtained from the school and also from each student involved in the study. A self-administered questionnaire was distributed in order to obtain demographic data, family history and other necessary information before proceeding to the eye tests for myopia, hypermetropia, astigmatism and colour blindness (daltonism).

The eye tests were carried out in a well illuminated and prepared environment for the assessment of the visual acuity of the participants. The Snellen's chart test was used to assess far sight acuity. The chart was placed at a distance of 20 feet from the participant and then the participant was asked to read out. Normal vision was attributed to a 20/20 vision. Hypermetropia was examined among the volunteers using the Jaeger's chart which was placed at 14 inches away, allowing them to read it in order to determine their short sight acuity. The recording was made similar to that of Snellen's chart test. The Ishihara pseudo-isochromatic chart was also placed at 14 inches from the participants to determine any defect in color acuity of their sights. The Green's astigmatism chart was placed 14 inches away from the participant to observe for corneal irregularity and areas of blurred vision were recorded. In order to register proper values, four medical students in the senior MD classes were trained and maintained for all the tests, thus reducing variability in assessments. Students who appeared positive to any test were advised to go for further evaluation and treatment at a standard ophthalmic center.

All the tests were carried out in both eyes separately for any significant variation. Results were grouped and analyzed by Stata package 13 using chi square and linear regression. Statistical significance was kept constant at $P<0.05$.

3. Results

A total of 200 subjects were examined. The median and mode for ages were 20-22 and 17-19 years respectively. Volunteers consisted of 74 (37%) males and 126 (63%) females with occurrence of 99 (49.5%) eye defects. Amongst the students tested, prevalence of myopia, hypermetropia, colour blindness (daltonism) and astigmatism were 61 (30.5%), 24 (12.0%), 6 (3.0%) and 67 (33.5%) respectively. The prevalence rates and

statistical significance of various parameters among students in premedical (PreMed) and medical classes (MD) were also calculated (table 1). Most students fell in the age group of 20-22 years and thus the highest occurrence of eye defects with the incidence of 34 (34.3%). Further observations showed that within the age group of 20-22 years, 20 (58.8%) cases of eye defect were found among girls. Obtained data also showed that among the female students examined, the highest rate of eye defect was identified within 17-19 years with incidence of 28 (80%), while highest prevalence among boys was within the age range of 20-22 years with 14 (41.2%) cases.

A total of 34 (45.9%) males and 65 (51.6%) females presented with eye defects with no statistical significant difference ($P>0.05$). The male and female participants showed more occurrence of astigmatism than any other visual defect with an incidence rate of 22 (29.73%) and 45 (35.71%) respectively. All the defects tested for were more among females than males.

43 (21.5%) students were observed with more than one eye defects at a time. Incidence of eye defects were also related with student's demographic data, family history and personal history with regards to eye functionality (table 2). Interaction between degree of exposure to electronic screen and visual acuity were also calculated (table 3). Among the coexisting eye defects, myopia and astigmatism was observed to have a high simultaneous presentation in students with frequency of 31 (46.27%).

Further analysis revealed that myopia was the major reason why students visited an ophthalmologist, with an incidence rate of 35 (36.1%). Myopia was also observed to be the commonest defect among family members with a value of 37 (36.6%). Detailed questioning of volunteers revealed that mothers and fathers were the major victims of visual defect in the family, 37 (24.7%) and 33 (22%) respectively.

Visual impairment were observed more in MD classes with occurrence of 54 (54.5%) cases than in Pre-Med classes. Students with poor consciousness in basic eye care had a high incidence of eye defects with observed values of 40 (76.5%) and statistical significance ($P<0.05$).

Students who possessed three or more gadgets (electronic devices) had more incidence of eye defects (79.8%), $p>0.05$. It was also observed that the incidence of eye defects had a positive correlation with increased time spent on screen, $p>0.05$. However, 72 (73.5%) students who appeared with eye defect acknowledged reading on printed books as convenient. 82 (82.82%) students identified with eye defects also acknowledged visual defect occurrence in their immediate family, $p>0.05$, while 17 (40.5%) students presented with eye defects despite no history of visual impairment in the family. 37 (37.4%) students also showed vision impairment with no previous ophthalmologist contact. Also, 51 (51.51%) students who did not complain of blurred vision presented with visual defects.

4. Discussion

The importance of testing for visual acuity was first realized during the recruitment of cadets during the Second World War [15]. This was necessary in ensuring proper functionality of military personals. It is also observed that the planning of a youth career is dependent on visual acuity and therefore early detection of refractive errors is essential in order to prevent permanent disability [16].

Table 1: Comparison between Pre-Med and MD classes based on various definitions

Baseline Characteristics	**n=84** **PreMed 1 – 4** **No.(%) or (mean) ± S.D.**	**n=116** **MD 1 – 4** **No.(%) or (mean) ± S.D.**	**P value (where applicable)**
Age	(17-19) ± .08	(20-22) ± 0.15	
Male	25 (29.8)	49 (42.2)	0.071
Students with at least one Ophthalmologist visit	39 (46.4)	64 (55.1)	0.222
Individuals with blurred vision without visual aid	9 (10.7)	17 (14.7)	0.611
Individuals with recommended visual aid	25 (29.8)	36 (31.0)	0.932
Individuals with blurred vision despite aid	10 (11.9)	12 (10.3)	0.877
Difficulty in distinguishing colors	6 (7.1)	7 (6)	0.754
Immediate family with vision difficulty	63 (75)	95 (81.9)	0.237
Number of electronic devices/gadget owned by each student (Predominantly three)	38 (45.2)	45 (38.8)	0.688
Students who prefer reading on screen	35 (41.7)	24 (20.7)	0.001
Student who spend more than 3 hours on screen	66 (78.6)	107 (92.2)	0.035
Students with eye defects	45 (53.6)	54 (46.6)	0.327
Students with more than one eye defect	23 (27.4)	20 (17.2)	0.213
Students with eye defect in both eyes	27 (32.1)	30 (25.9)	0.212
Students with myopia	24 (28.6)	37 (31.9)	0.614
Students with hypermetropia	14 (16.7)	10 (8.6)	0.084
Students with colour blindness	3 (3.6)	3 (2.6)	0.687
Students with astigmatism	36 (42.9)	31 (26.7)	0.017

Prevalence of eye defect among medical students in Dominica were closely related to the survey done in Denmark and Norway [14]. In contrast to gender, females appeared to have high occurrence of eye defects with early onset at 17-19 years. This could be attributed to the fact that females tend to acquire maximum physical growth at an early age than boys, values in table 2 also support the presumption [10,17]. Among students who had eye defects, 37.4% of students never visited an ophthalmologist and thus never knew of their defect(s), also

51.51% who had no visual complains presented positive to visual defect. Thus, early detection of eye defect may be essential in curbing most of these impairments, hence reducing further damage.

Table 2: Prevalence of Eye Defects Based on Student's History

	Occurrence of eye defects in:						
Eye Defects	**Males n (%)**	**Females n (%)**	**Students with no ophthalmologist Visit n (%)**	**Students with no visual aid n (%)**	**Students with no visual aid but with blurred vision n (%)**	**Students with history of eye defect in nuclear family n (%)**	**Students with no conscious care for the eye n (%)**
Myopia	19 (25.68)	42 (33.33)	16 (26.32)	27 (44.26)	16 (26.23)	51 (83.61)	17 (27.87)
Hypermetropia	7 (9.46)	17 (13.49)	8 (33.33)	9 (37.50)	8 (33.33)	20 (83.3)	7 (29.17)
Colour Blindness	2 (2.70)	4 (3.17)	1 (16.67)	3 (50.00)	2 (33.33)	6 (100)	3 (50.0)
Astigmatism	22 (29.73)	45 (35.71)	26 (38.81)	37 (55.22)	11 (16.42)	55 (82.09)	32(47.76)

In our study, myopia and astigmatism were observed to be the most occurring eye defect, which could be attributed to their association with increased educational demand, thus, much more occurring among medical students [14]. This could also account for myopia being the major reason for ophthalmologist visits by students. Due to increased time of exposure of medical students to electronic gadgets, students in the MD classes appeared to have more incidence of eye defect than PreMed students. However, there were no significant difference since the time gap between these classes are not so wide. The increased exposure of students in the MD classes to electronic screens (table 1) may be the reason for more cases of eye defects than in PreMed students. This is usually caused by the toxic effect to adverse blue light which possess tendency to cause eye strain, macular degeneration as well as other defects [13]. To support this, analysis of this study showed that cases of eye defects were directly proportional to the number of gadgets/electronic devices owned by students (table 3).

The study also observed that the number of cases of myopia and astigmatism occurring together were more in comparison to other eye defects. This suggests that there may be a correlation between these two defects. Several postulations have been made concerning this observation. Among several, suggestions have been

attributed to the fact that infantile astigmatism can disrupt emmetropization by reducing an infant sensitivity to focusing signals, thus leading to underaccomodation or alignment impairment with a physiological fix of elongated eye ball [18]. Other proposals have also pointed out that ocular growth in susceptible individuals may have stimulated the forced stretching of the ciliary muscles, leading to astigmatism associated with myopia [19]. Aside familial contribution and other factors, intelligence and education have been closely associated with myopia, thus giving the reason for its high occurrence in this study [20,21].

Table 3: Prevalence of Eye Defect in Correlation to Electronic Devices

	Occurrence of eye defects in:								
Eye Defects	**Students with various number of engaged gadget(s) n (%)**				**Students who prefer electronic screen for studies n (%)**	**Students with various time range on electronic screens n (%)**			
	1 in use	**2 in use**	**3 in use**	**>3 in use**		**1-3 hours**	**4-6 hours**	**7-9 hours**	**>9 hours**
Myopia	1 (1.64)	13 (21.31)	26 (42.62)	21 (34.43)	15 (25.59)	7 (11.48)	23 (37.70)	19 (31.15)	12 (19.67)
Hypermetropia	0	4 (16.67)	11 (45.83)	9 (37.50)	7 (29.17)	3 (12.50)	9 (37.50)	10 (41.67)	2 (8.33)
Colour Blindness	0	2 (33.33)	1 (16.67)	3 (50.0)	3 (50.0)	2 (33.33)	2 (33.33)	1 (16.67)	1 (16.67)
Astigmatism	1 (1.49)	11 (16.42)	33 (49.25)	22 (32.84)	17 (25.76)	12 (17.91)	20 (29.85)	19 (28.36)	16 (23.88)

Of the 82 students who presented with eye defect also attested to visual impairment in the family, with more presentation among fathers and/or mothers. Apart from familial linkage, eye defect also tend to be present with poor eye hygiene as shown in this study with 76.5% association. The reason for more eye defects connected with students who preferred reading on electronic screen could be tied to the fact that students do not know the toxic effect of blue light emission and may study on screens than printed material due to avoidance of additional cost and also for easy convenience of transporting material.

5. Conclusion

The screening for eye defect in a medical school located in the Caribbean with the result of almost 50% of students suffering, shows that eye defect is a common issue among medical students. The study shows that although these students are medically oriented, they need to be advised to register for frequent eye checkup, as this can help arrest visual impairment at early onset, especially for students who have familial predisposition.

Aside early checkup, student caretaker should be educated on ocular hygiene, as well as eye health. Students should be advised on diets and lifestyle that promote better eye health in order to reduce chances of visual impairment. Students also need to be advised about the effects of electronic screen on eye functionality and the safe number of hours to be spent on electronic screens. University management should also be advised to take necessary actions by reducing the amount of e-document circulation, while use of printed materials should be encouraged.

References

[1] M. Smith and J. Strottmann, "Imaging of the optic nerve and visual pathways", Seminars in Ultrasound, CT and MRI, vol. 22, no. 6, pp. 473-487, 2001.

[2] B. Burton, "Neuro-ophthalmology", in Clinical Ophthalmology A Systemic Approach, 6th ed., J. Kanski, Ed. Butterworth Heinemann: Elsevier, 2007, pp. 785-836.

[3] D. Purves, G. Augustine and D. Fitzpatrick, "Visual Field Deficits", in Visual Field Deficits, 2nd ed., D. Purves, J. Augustine, D. Fitzpatrick, L. Katz and A. Samuel, Ed. Sunderland: Sinauer Associates, 2001, pp. 49-56.

[4] I. Midi, "Disorders of optic nerve and visual pathway", 2014. [Online]. Available: http://cdn.intechopen.com/pdfs-wm/46503.pdf. [Accessed: 10- Feb- 2016].

[5] A. Maheshwari and D. Williams, "Learning optics using vision", 2001. [Online]. Available: http://cfao.ucolick.org/EO/resources/Learn_optics_AO.pdf. [Accessed: 14- Feb- 2016].

[6] S. Vitale, "Increased Prevalence of Myopia in the United States Between 1971-1972 and 1999-2004", Archives of Ophthalmology, vol. 127, no. 12, p. 1632, 2009.

[7] V. Castagno, A. Fassa, M. Vilela, R. Meucci and D. Resende, "Moderate hyperopia prevalence and associated factors among elementary school students", CiÃªnc. saÃºde coletiva, vol. 20, no. 5, pp. 1449-1458, 2015.

[8] H. Hashemi, S. Asgari, A. Yekta, H. Ostadimoghaddam, B. Haghighi, S. Soroush, H. Shafiee and M. Khabazkhoob, "Prevalence of Astigmatism in 4- to 6-Year-Old Population of Mashhad, Iran", Journal of Comprehensive Pediatrics, vol. 6, no. 1, 2015.

[9] H. Rathod, P. Raghav and S. Mittal, "Profile of School going children with visual impairment", Indian Medical Gazette, vol. 411, no. 7, pp. 434-437, 2011.

[10] A. Datta, N. Bhardwaj, S. Patrikar and R. Bhalwar, "Study of disorders of visual acuity among adolescent school children in Pune", Medical Journal Armed Forces India, vol. 65, no. 1, pp. 26-29, 2009.

[11] J. Silva, J. Bateman and F. Contreras, "Eye Disease and Care in Latin America and the Caribbean", Survey of Ophthalmology, vol. 47, no. 3, pp. 267-274, 2002.

[12] T. Akinbinu and Y. Mashalla, "Impact of computer technology on health: computer vision syndrome (CVS)", Medical practice and preview, vol. 5, no. 3, pp. 20-30, 2014.

[13] R. Akinbinu, "Knowledge of computer vision syndrome among computer users in the workplace in Abuja, Nigeria", J. Physiol. Pathophysiol., vol. 4, no. 4, pp. 58-63, 2013.

[14] W. Woo, K. Lim, H. Yang, X. Lim, F. Liew, Y. Lee and S. Saw, "Refractive errors in medical students in Singapore", Singapore Medical Journal, vol. 45, no. 10, pp. 470-474, 2004.

[15] E. Davens, "The nationwide alert to pre-school vision", Screening sight saving review 1:180-184, vol. 1, pp. 180-184, 1996.

[16] R. Mukherjee and S. Seal, "An epidemiological study of refractive errors among school children in Calcutta.", Journal of Indian Medical Association, vol. 73, pp. 59-64, 1973.

[17] K. Venkatramana and T. Naduvilam, "Visual impairment in school children in Southern India", Indian Journal of Ophthalmology, vol. 45, no. 2, pp. 129-134, 1997.

[18] M. Ukwade and H. Bedell, "Stereothresholds in persons with congenital nystagmus and in normal observers during comparable retinal image motion", Vision Research, vol. 39, no. 17, pp. 2963-2973, 1999.

[19] J. Gwiazda, K. Grice, R. Held, J. McLellan and F. Thorn, "Astigmatism and the development of myopia in children", Vision Research, vol. 40, no. 8, pp. 1019-1026, 2000.

[20] K. Au Eong, T. Tay and M. Lim, "Race, culture and myopia in 110,236 young Singaporean males", Singapore Medical Journal, vol. 34, pp. 29-32, 2014.

[21] S. Saw, J. Katz, O. Schein, S. Chew and T. Chan, "Epidemiology of Myopia", Epidemiologic Reviews, vol. 18, no. 2, pp. 175-187, 1996.