Color Vision Defects in School Going Children

Shrestha RK,[1] Joshi MR,[2] Shakya S,[1] Ghising R[1]

[1] Department of Ophthalmology, Nepal Medical College Teaching Hospital, Jorpati, Kathmandu, Nepal, [2]Department of Ophthalmology, Om Hospital and Research Center, Chabahil, Kathmandu.

ABSTRACT

Introduction: Color vision defect can be observed in various diseases of optic nerve and retina and also a significant number of people suffer from the inherited condition of red and green color defect.

Methods: A cross-sectional descriptive study was designed with purposive sampling of students from various schools of Kathmandu Valley. All children were subjected to color vision evaluation using Ishihara Isochromatic color plates along with other examination to rule out any other causes for color deficiency.

Results: A total of 2001 students were examined, 1050 male students and 951 females with mean age of 10.35 (±2.75) and 10.54 (±2.72) respectively. Among the total students examined, 2.1% had some form of color vision defects. Of the male population, 3.9% had color vision defects while none of the female was found with the deficiency.

Conclusions: The prevalence of color vision defect in Nepal is significant and comparable with the prevalence quoted in studies from different countries.

Keywords: *color vision, congenital red green color defect, Nepal, prevalence*

INTRODUCTION

Color vision is one of the important components of visual perception; significant populations suffer from an inherited condition of red/green color defects besides other seen in different retinal and optic nerve diseases.[1] Similarly people with abnormal colour vision are reported to have a significantly higher rate of road accidents.[2]

As visual medium is used more in teaching learning activity, child with color vision defect may be at disadvantage when compared with normal children; significantly lower school achievement as assessed by school marks has been reported for children with abnormal colour vision compared colour normal children.[3]

Various professions require normal color vision, anyone who is color blind should be advised against training for such occupations as pilots, certain jobs in armed forces, electrical jobs, navigators, police.[4] Histopathologists and medical scientific officers can be at a considerable disadvantage in work if they have impaired color vision.[5]

Correspondence:
Dr. Rajesh K. Shrestha
Department of Ophthalmology
Nepal Medical College Teaching Hospital
Jorpati, Kathmandu, Nepal.
Email: drrajeshr1@yahoo.com
Phone: 4911008, Ext. 222

Therefore, a study was conducted at different schools around Kathmandu to evaluate all students studying there for color vision.

METHODS

A cross-sectional descriptive study was designed to evaluate the color vision of children. A purposive sampling of various schools of Kathmandu Valley was done after taking consent from the school authority as well as the students' guardians for the examination. A team comprising of Ophthalmologist, Optometrist and Ophthalmic Assistant visited four different schools around the Kathmandu valley for evaluation.

All the willing students from grade one to ten of these schools were included in the study. Every child was examined thoroughly including visual acuity with the help of internally illuminated Snellen's Vision Chart, anterior segment evaluation with the help of slit lamp (Haag Streit 900). The posterior segment was evaluated with the help of direct ophthalmoscope and/or Slit Lamp biomicroscope with +90Ds lens. Students who had significantly reduced visual acuity (< 6/60) even after refractive correction and any ocular pathology which could affect their performance in color vision screening were excluded from the study and referred to base hospital for further evaluation.

The Isihara pseudoisochromatic plates were used to evaluate the color vision of children under natural day light condition. The number plates of the Ishihara chart were used and the abnormality was differentiated accordingly. The data obtained was entered and tabulated for statistical data analysis. Microsoft Excel was used for the purpose.

Those having any color vision defects were called back to base hospital along with their guardians where further evaluation was carried out to rule out any acquired cause for the defect. Proper counseling was done regarding the different aspects of disorder such as course of the disorder, the adverse affect it can have on the person's choice for future career and inheritance to their offspring as well as possible defect in other family members.

RESULTS

A total of 2001 students were evaluated from four different schools of the Kathmandu valley among which 1050 were males and 951 females (Table 1).

Among all the students evaluated 41(2.05%) were found to have some kind of color vision defects. No obvious acquired cause for color vision defect was observed. All the students affected were males, which is 3.9% of total male population (Table 2). None of the female students examined were found to have any form of color vision defects.

Table 1. Age and Sex distribution of students

Particulars	Number
Total Students	2001
Males	1050
Females	951
Mean age (SD) Male	10.35 (2.75) years
Mean age (SD) Female	10.54 (2.72) years

Table 2. Students with color vision defects

Gender	Total Screened	No. of affected	Percentage
Male	1050	41	3.9%
Female	951	0	0.0%

Among the 41 students having color vision defects, six were found with total color blindness, 34 were found to be Deutan and rest Protan (Table 3).

Table 3. Distribution of various types of color vision defects

Type	Numbers	Percentage(Male, N = 1050)
Total color blindness	6	0.57%
Strong Deutan	32	3.05%
Mild Deutan	2	0.2%
Mild Protan	1	0.09%
Total	41	3.9%

DISCUSSION

The prevalence of congenital color blindness of 3.9% among male population is similar to the prevalence of color blinds in different reports from various countries. A study among school children of Patiala city, India reported 3.85% males and 0.38% females to be colour-blind.[6] In study of type of color blindness in Ethiopian population, 4.2% of males and 0.2% of females were found to have various forms of color blindness.[7] Similar study in Jat Sikhs of Patiala city of India, reported an incidence of 3.83% and 0.13% in males and females respectively.[8]

A school based study among secondary-school students in Tehran using Ishihara plates reported color vision defects in 8.18% of males and 0.43% in females[9] which is more than twice the prevalence found in our study. Similarly a study in Korean population reported congenital color vision defects in 5.9% of male and 0.44% of female population.[10]

Regarding various types of defect, Zein ZA found 3.2% deutans and 0.9% protans among Ethiopian males. In this study also 3.25% of males were deutans while 0.09% protans.[7]

These different studies indicate the prevalence of congenital color vision deficiency to be 2-6% in male population with very minimal of female being affected. So the trend is similar in our country as well. The incidence of male being affected is explained by the X-linked genetic inheritance pattern of the disorders; in which males are affected and female are carrier. The inheritance pattern of Y-linked and sometimes with confused pattern in others have also been reported in very few persons, this possibly explains the number of female population affected.[11] No female were found to be affected in this study.

The prevalence of color vision disorder is quite significant as nearly 4 out of 100 male suffer from some form of color vision disorder that would affect the course of their choice for the future career. If this disorder can be detected at an early age and if proper counseling is done, regarding the limitation this can pose on the future career of the students, a large number of people can be saved from the psychological stress of having to choose another profession after one has prepared for a specific profession for many years.

This study evaluates the status of color vision in Nepali population that was undertaken with the use of Ishihara color vision plates. The Plates are based on the principle of pseudoisochromatic color differentiation and is the wide spread method used for general screening of color vision. It would be worthwhile to come up with report of the same disorder with more tests, which can categorize the defects more substantially as Monochromats, Dichromats and others. The tests like Dichomatous D-15 Test; Munsell 100 Hue Test and anomaloscope would prove significant in this regard.

CONCLUSIONS

Significant male population suffers from the congenital color vision disorder. Those with congenital color vision disorder should be properly counseled regarding difficulties in everyday work, their future profession, genetic inheritance to their children, which would prepare them for the any future challenges and confusions.

ACKNOWLEDGEMENT

We would like to thank management of Om Hospital and Research Center for providing the logistic support during this study.

REFRENCES

1. Steward SM, Cole BL. What do colour vision defectives say about everyday tasks? Optom Vis Sci 1989; 66: 288-95.
2. Verriest G, Neubauer O, Marré M, Uvijls A. New investigations concerning the relationships between congenital colour vision defects and road traffic security. Int Ophthalmol 1980; 2: 87-99.
3. Grassivaro Gallo P, Panza M, Viviani F, Lantieri PB. Congenital dyschromatopsia and school achievement. Percep Motor Skills 1998; 86: 563-67.
4. Taylor WOG. Effects on employment of defective color vision. Br J Ophthalmol. 1971;79:447-52.
5. Holroyd E, Hall DMB. A re-appraisal of screening for color vision impairments in Edingburgh. Child care, Health and Devel. 1997;23:391-8.
6. Mahajan OP, Gogna RS. Study of colour blindness in school children. Indian J Physiol Pharmacol. 1977;21(1): 59-62.
7. Zein ZA. Gene frequency and type of colour blindness in Ethiopians. Ethiop Med J. 1990;28(2):73-5.
8. Naresh S. Study of colour blindness in Jat Sikhs. Indian J Physiol Pharmacol. 1995 Apr; 39(2):127-30.
9. Modarres M, Mirsamadi M, Peyman GA. Prevalence of congenital color deficiencies in secondary-school students in Tehran. Int Ophthalmol. 1996-97;20(4):221-2.
10. Kim HB, Lee SY, Choe JK, Lee JH, Ahn BH. The incidence of congenital color deficiency among Koreans. J Korean Med Sci. 1989;4(3):117-20.
11. Emery AEII. Elements of Medical Genetics. 6th ed. Churchill Livingstone: Edinburg; 1983.