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ORIGINAL RESEARCH ARTICLE

THE BURDEN OF COLOR VISION DEFECT IN NEPAL – AN ICEBERG PHENOMENON

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ABSTRACT

Background: Color vision tests are routinely performed and are mandatory in most part of the world. However, in Nepal and many other developing countries, color vision may often be overlooked. We evaluated a possible burden of color vision in a group of patients who were specifically evaluated for a color vision defects. This study evalutes the awareness of color vision defect among the patients evaluated and highlights the importance of the color vision evaluation.

Methods: A sequential group of 73 people from August to September 2017 specifically evaluated for color vision defect for recruitment of government employment were evaluated. Ishiharapseudo-isochromatic plates and Farnsworth-Munsell Dichotomous D-15 test were used for screening. Mean and Standard deviation were used for descriptive analysis of the data.

Results: Fifty-seven were male and sixteen were female. The mean age was 23 years (SD ± 3.7). On evaluation of the color vision defect, 9 (12.3%) were found to have total color vision defect (achromatopsia), 3 (4%)-red-green defect and 1(1%) with blue red defect. None of the patients had undergone color vision test at eye hospital previously. There were 4 patients who were registered drivers who had color vision defect.

Conclusions: Color vision is an important part of the vision. It should not be ignored.All of the patients evaluated were found to be unware of their condition. Early detection of color vision defects in individuals, if possible, at school level can help them to determine their careers and future endeavors at early stage.

INTRODUCTION

Color vision deficiency (CVD) occurs due to defect in the development of one or more types of retinal cone cells that perceive color during embryogenesis of the eye.[1]There are various combinations of color vision defect but red-green defect has found to be the most prevalent.[2]The red-green color defect is further classified into more severe form – also known as the dichromatic color defect (protanopia and deuteranopia) or a milder form- also known as the anomalous trichromatic color defect (protanomaly and deuteranomaly).[2,3]

When color vision deficiency is severe, the condition can have a significant impact on a person's life. People with color vision deficiency have a major disadvantage limiting them from various tasks and professions – e.g.: Driving, military personnel, pilots, air traffic controllers or medical personnel to mention some.[4]Colorblind people are likely to be rejected from such professions. These professions are highly demanding not only in concentration, alertness and good visual acuity but also in a good color vision. Thousands of lives could be at risk due to the failure of detecting color vision among them during recruitment. Hundreds of people often find out they have color vision defect which makes them ineligible to join a job often at the last minute of recruitment procedure.[5] The mental trauma of rejection from their dream career can often be devastating. The bitter truth that there is no treatment for this condition adds further misery to their state of mind despite the best of counseling.[6] This study was conducted to evaluate the awareness, prevalence and distribution of color vision defect among a group of patients who specifically came for color vision evaluation.

METHODS

This study was a retrospective cross-sectional review of patients evaluated at tertiary eye center. All, (73) consecutive patients who underwent ocular examinations from August to September 2017 and were specifically evaluated for color vision defect for recruitment of government employment. Ishiharapseudo-isochromatic plates (38-plate edition) and Farnsworth-Munsell Dichotomous D-15 test were used for screening.[7]

Patients with media opacities, retinal/ optic nerve pathologies, previous medical conditions/treatment which may cause retinal / optic nerve disorders and history of intraocular surgery (e.g. vitreoretinal procedures, glaucoma filtration surgeries), were excluded from the study. The research has been ap-

proved by the ethics committee and the institutional review board of Birat eye hospital, Biratnagar, Nepal and has adhered to the tenets of the declaration of Helsinki.

For every eligible patient, ocular examination was done and findings were recorded. Collected variables included the patient's age, gender, visual acuity, intraocular pressure (IOP) and color vision evaluation. Furthermore, detailed medical, ocular, surgical, and medication histories were recorded from patient files. Patient underwent comprehensive ocular examination using Topcon SL-D301 slit lamp. Visual acuity was measured using Snellen's chart at 6 meters according to International Council of Ophthalmology (ICO) norms. Color vision was evaluated using Ishiharapseudo-isochromatic plates (38-plate edition) and Farnsworth-Munsell Dichotomous D-15 as per the norms of National Research Council (US) Committee on Vision. Procedures for Testing Color Vision. In Ischihara pseudo-isochromatic plates the patients were asked to identify a different colored symbols/numbers or pathways mixed with background and corresponding defects were noted. In, Farnsworth-Munsell Dichotomous D-15, which is basically an arrangement tests- the patient was asked to arrange color samples by best matching next color in a sequential order. This was plotted and the color vision defect was confirmed. This test added further value to the Ishihara test given that – some amount hue discrimination and a full evaluation for color confusion were determined using Farnsworth-Munsell Dichotomous D-15. Statistical analysis was performed using SPSS (version 20, SPSS Inc., Chicago). Mean, frequency tables and standard deviation were used to tabulate the data evaluated.

RESULTS

A total of seventy three patients were evaluted. Fifty-seven were male and sixteen were female. The mean age was 23 years (SD 3.7yrs). On evaluation, 13(17.8%) of the total patients examined presented with color vision defect (Table 1).

Nine of the patients were found to have total color vision defect (achromatopsia), 3 were found to have a red-green defect and 1 with a blue-red defect. All 9 patients with total vision defect and 3 patients with red-green defects were male. The blue-red defect was found in 1 female patient. None of the patients had undergone color vision test at eye hospital previously. One of them were aware of their condition and only 5 of the patients had heard of color vision defect. Among them, 4 of the patients -3 with total color vision defect and 1 with red-green defect were registered drivers. Their visual acuity was 6/6 unaided. When specifically asked if they had any other complaints such as intolerance to bright light or difficulty in performing task at different time of the day, they all denied of such symptoms. This however could be confounded by the fact that the patients could be intentionally denying their symptoms in attempt to produce a flawless ocular status certificate (Table 2).

Table 1: Demographics and Color vision defect characteristics of patients applying for government job who were evaluated specifically for color vision.

General Characteristic	Color Vision test (N= 146 eyes from 73 patients)
Age	
Mean (Standard Deviation)	23 years (SD 3.7yrs).
Gender	
Male	57(78%)
Female	16(22%)
Education status	
Bachelor's Degree	51 (70%)
Master's Degree	22(30%)
Color vision defect	13 (17.8%)
Total color vision defect	9(69%)
Red green defect	3(23%)
Blue red defect	1(8%)

Table 2: Distribution of Color vision defect and awareness of theircondition.

Male(Male patients with color vision defect/ Total Male Patients)	12/57 (21.0%)
Female(Female patients with color vision defect/Total Female Patients)	1/16(6.25%)
Driving license holders among impaired color vision group.	4(31%)
Patients who had never had color vision examination	67(92%)
Patients with color vision defect who did not know they had the condition	13(100%)

DISCUSSION

The number of patients with color vision defect detected incidentally in such a short period and asmall group of patients could present only as a tip of the iceberg in general population. Lack of awareness and low priority in the evaluation of color vision could be few of the many reasons for under-diagnosis.

Our study found the point prevalence of color vision blindness in a specific population to be 17.8% out of which more than 90% (12/13) of the patients with color vision defects were male. Although the study population was different, the results we obtained was not much different from what Godar et al[8] have reported. They evaluated patients attending a tertiary eye care centre in the western part of the Nepal and reported that 74.72% of the patients with color vision defect were male.

Color vision is most essential in both civil and professional terms. Our findings suggested that many of the patients were not aware of their condition till the time of examination. This had a great implication that despite their capability, color vision defect meant an auto-disqualification. The study on impact this will have on the patients is beyond the scope of this study and further studies with long term follow-up could illustrate this precisely.

The disturbing finding that even people with severe color vision defects being granted driver's license in a country with one of the most dangerous roads in the world also questions the integrity of the concerned authorities. Colors attract attention and most of the traffic signs/symbols are designed in same manner to alert drivers of potential danger[9]It is a well-known fact that drivers with color vision defects are more likely to cause accidents.[10] Our study found that 4 out of 13 patients with color vision defect were legal driver license holders. It is alarming that even in a very small and specific sample size, this is considerably high.

Another key issue to highlight is Nepal has recently also emerged as one of the key countries of human resource in recent years. Nearly 1,600 Nepalese were leaving each day for employment abroad, primarily to Gulf countries in 2014.[7] The remittances account nearly 25 percent of Nepal's GDP.[9] Foreign exchange earnings from remittance have surpassed the total of export receipts and official aid to the country together combined.[11]

Most of the people who leave the country are painters, electricians, drivers and security forces. They are in high need of color vision. Any undetected or missed diagnosis of their color vision during their recruitment may not only undermine their job security and dismissal but also undermine the reputation of ophthalmic care of Nepal. Although we did not evaluate this population, the findings from our study raises a concern and we believe that a mandatory eye examination should not be limited to general physicians but should be done with assistance from or trained and registered eye care workers.

Nepal's eye health has been improving rapidly and the country also boasts one the best eye care in the Asian region despite the limited resources and manpower.[13] But if such sensitive issue of color vision continues to go unaddressed, the general public will remain unaware of the condition and of all the consequences that are tied along with it. We believe our study only highlights the tip of the iceberg. We specifically searched for color vision defects in a specific group of people and the results are alarming. It is vital to get a clear picture of color vision defect in Nepalese population may be achieved by implementing mandatory color vision screening at any eye screening /ocular examination.

We only evaluated a small group of patients and of a specific geographical area of Nepal so this study cannot be generalized. Further a multicenter study with large sample size to evaluate the burden of color vision defect.

CONCLUSIONs

We Color vision is an important part of the vision. It should not be ignored. Early detection of color vision defects in individuals -if possible, at school level can help them to determine their careers and future endeavors at an early stage. This can help them to find adaptive strategies, which can prevent disappointments in the choice of their future career. The parental education, awareness, genetic counseling is also equally important to help understand the condition and the possibility of transference of the disorder to their offspring. We recommend color vision test to be made mandatory to all the patients visiting eye hospitals and also to be included in school eye health screening programs in Nepal.

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CONFLICT OF INTEREST

None

FINANCIAL DISCLOSURE

None

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