Color blindness in dental profession: An issue unexplored

Dear Editor,

Esthetics plays a vital role in achieving patient satisfaction in restorative and prosthetic dentistry. The demand of high esthetic outcomes is achieved through the production of an acceptable morphology and shade reproduction in a restoration.[1,2] Perception of color is a complex process, which depends on various factors, whereas the ability to match the shade of the required prosthesis to that of adjacent natural teeth is an important goal of restorative dental procedures.[3,4]

Color blindness, in its congenital form, is the product of genetic mutations that affect expression of three types of cone cells present in eye that respond differently to light of different wavelengths. In its genetic form, color blindness is seen as a common vision disorder, especially, seen in males (gene defect arises on X chromosome within Xq28 band).[5,6]

There is evidence to suggest that color vision is integral to a number of dental specialties, particularly, restorative and prosthetic dentistry.[7] The aim of this research was to evaluate prevalence of color blindness amongst dental professionals. Identifying and informing dental professionals with color blindness should, thus, allow the personnel to receive necessary support and training to pursue a successful career.

The present research was conducted in a cross-sectional study design that included 198 dental professionals including faculty and students who were asked to fill questionnaire followed by which their color vision status was evaluated using Ishihara test. Six color plates were shown to each subject and subjects were asked to detect numbers in color plates and write them in questionnaire provided while positive results were re-assessed for probability of being false positive by advanced examination using 17 color plates. The results obtained were subjected to statistical analysis.

The prevalence of color blindness in total sample studied was found to be around 3.54% while a general trend for increase in probability of color blindness was observed with increasing age. Also, prevalence was more in males than females and with record higher number of cases reported from faculty than students ($P < 0.05$) [Table 1].

Vision is a psycho-physical phenomenon based on sensitivity of cone cells to wavelengths between 400 and 700 nm of the electromagnetic spectrum. There are about 6–7 million cone cells in human eye which are mostly concentrated towards macula. These cells are less sensitive to light than rod cells, although allow perception of color. They are, also, able to perceive finer details and more rapid changes in images because their response times to stimuli are faster than rod cells.[8]

Because human eye usually has three kinds of cone cells with different light receptive pigments or, proteins called photopsins with different response curves, human eye is said to have trichromatic vision. These three pigments vary in their composition due to genetic influences and

| Age group (in years) | Normal | Color Vision Defect | Total |
|----------------------|--------|---------------------|-------|
| 17-21                | 101    | 3                   | 104   |
| 22-26                | 71     | 2                   | 73    |
| 27-31                | 14     | 2                   | 16    |
| 32 and above         | 5      | 0                   | 5     |
| Total                | 191    | 7                   | 198   |

Chi-square=4.218, $P=0.239$

| Gender | Normal | Color Vision Defect | Total |
|--------|--------|---------------------|-------|
| Male   | 49     | 5                   | 54    |
| Female | 142    | 2                   | 144   |
| Total  | 191    | 7                   | 198   |

Chi-square with Yates’s correction=5.0120, $P=0.0250$*

| Designation | Normal | Color Vision Defect | Total |
|-------------|--------|---------------------|-------|
| Faculty     | 16     | 1                   | 17    |
| Students    | 175    | 6                   | 181   |
| Total       | 191    | 7                   | 198   |

Chi-square with Yates’s correction=0.0001, $P=1.0000$. *$P<0.05$- statistically significant
thus, different individuals have cones with different color sensitivity.[3,4] Furthermore, since there are three types of cone cells responsible for spectral sensitivity for color perception, when a single type of color receptive cones are missing, it results in color blindness.[10,11]

The most commonly used tests for color vision deficiencies are the Ishihara and the Richmond HRR test.[3,12] Ishihara test was employed in the present research. The series of Ishihara color plates are designed to give a quick and accurate assessment of color vision deficiencies of congenital origin.[3] However, it must be noted that the ability to grade the severity of color vision defects is limited and results from such tests cannot yet be used as a basis for deciding on the severity of color vision defect.[3,13]

Numerous studies have shown that color vision defects are common amongst dental professionals including students and do affect their abilities.[3,6] The findings of this research were found to be in close accordance with the study conducted by Moser et al.[3] who found 9.95% prevalence and Bamise et al.[4] who recorded 6.3% prevalence of color blindness in their studies with reported higher prevalence in males (8.4%) than in females (3.9%).

Likewise, Barghi et al.[14] and Wasson and Schuman,[15] also found similar prevalence in their studies with males being affected more than females signifying sex-linked nature of this condition analogous with the findings of present research. The present research, also, reported 3.54% prevalence of color blindness with record higher number of cases reported from males (9.26%) than females (1.39%) ($P < 0.05$).

It is of interest to note that despite color perception plays an important role in dentistry, unfortunately, not many of the dental professionals are aware of this limitation.[15] The purpose of this research was to create awareness about this type of compromise in dental professionals while they were totally unaware of it.

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There are no conflicts of interest.

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