Journal of Dental Applications

Open Access

Austin Publishing Group

Research Article

Prevalence of Color Blindness in Dental Professionals: A Survey

Sanjay N[1], Budhiraja Sakshi M[2], Komuravelli Anil K[3], Khandelwal Rownak O[4] and Nayyar AS[5]*

[1]Professor and HOD, Department of Prosthodontics, Saraswati Dhanwantari Dental College & Hospital and Post-graduate Research Institute, Parbhani, India

[2]Post-graduate student, Department of Prosthodontics, Saraswati Dhanwantari Dental College & Hospital and Post-graduate Research Institute, Parbhani, India

[3]Reader, Department of Prosthodontics, Saraswati Dhanwantari Dental College & Hospital and Post-graduate Research Institute, Parbhani, India

[4]Post-graduate student, Department of Oral Medicine and Radiology, Saraswati Dhanwantari Dental College & Hospital and Post-graduate Research Institute, Parbhani, India

[5]Reader cum PG Guide, Department of Oral Medicine and Radiology, Saraswati Dhanwantari Dental College & Hospital and Post-graduate Research Institute, Parbhani, India

***Corresponding author:** Abhishek Singh Nayyar, 44, Behind Singla Nursing Home, New Friends' Colony, Model Town, Panipat, Haryana, India

Received: November 07, 2017; **Accepted:** November 28, 2017; **Published:** December 05, 2017

Abstract

Context: Color blindness is one of the potential factors affecting the ability of color perception and shade matching which is necessary for acceptable esthetic outcomes in dentistry.

Aim: The aim of the present study was to evaluate the prevalence of color blindness amongst dental professionals.

Materials and Methods: A total of 200 dental professionals which included dental students, faculty members and dental technicians were randomly selected as subjects for the present study. A questionnaire containing information about their age, gender and designation was filled by each subject and their color vision status was evaluated using the ISHIHARA test. Color blindness amongst subjects between different age groups, gender and designations was recorded. The investigators were adjudged not to be color blind by comparing the results of the Ishihara test administered to them.

Statistical Analysis: The data obtained was subjected to statistical analysis and analysed using SPSS version 10.

Results: The prevalence of color blindness was found to be 3.5%. The prevalence was more in males (8.93%) than in females (1.39%) giving the Male:Female ratio of 6.4:1. Out of 200 subjects, 1 in 17 faculty members and 6 in 181 students were found to have a compromised ability to identify colors properly while none of the dental technicians were found color blind.

Conclusions: Though color blindness is not considered an Asiatric trait, the prevalence of color blindness in the present study was found to be 3.5%. Since dental professionals do not have their color vision tested at any time during their career, they should be screened for color vision defects before choosing the specialty.

Keywords: Color blindness; Dental professionals; ISHIHARA test

Introduction

Esthetics plays a vital role in achieving patient satisfaction in restorative and prosthetic dentistry. The demand of a high esthetic outcome is achieved through the production of an acceptable morphology and shade reproduction in a restoration [1]. The success of the currently available esthetic restorative dental materials depends on correct shade matching [2]. Perception of color is a complex process which depends on various factors [3]. The ability to match the shade of a porcelain-fused-to-metal, partial denture and implant-retained restoration to that of the natural teeth is an important goal of the restorative dentist [4]. Color vision defect affects the ability of shade matching as a defect in color vision may lead to difficulty in the perceiving of color [4,5]. Color blindness is a common color vision anomaly seen to exist in the population [6]. Color blindness, in its congenital form, is the product of genetic mutations that affect the expression of the three types of cones and is a common vision disorder, especially seen in males (gene defect arises on the X chromosome within the Xq28 band) with a prevalence of approximately 8% for males and 0.5% for females [5]. There is evidence to suggest that color vision is integral to a number of dental specialties, particularly, restorative and prosthetic dentistry and to specific tasks like shade matching [7,8]. The dental personnel can employ team approaches and virtual shade selection to achieve a more precise shade selection [4]. Identifying and informing dental professionals with color blindness should allow for the personnel to receive the necessary support and training to pursue a successful career. The present study was conducted to evaluate the prevalence of color blindness in the dental professionals to make them aware about their anomaly, if, it existed and to create awareness about this type of compromising ability which is useful in pursuing a successful career in restorative and prosthetic dentistry. The sampling frame included dental students, faculty members and dental technicians as they have prior theoretical knowledge about the concept of color.

Subjects and Methods

The present study was conducted to evaluate the prevalence of color blindness in the dental professionals to make them aware about their anomaly, if, it existed and to create awareness about this type of compromising ability which is useful in pursuing a successful career in restorative and prosthetic dentistry. The sampling frame included dental students, faculty members and dental technicians as they have

Citation: Sanjay N, Budhiraja Sakshi M, Komuravelli Anil K, Khandelwal Rownak O and Nayyar AS. Prevalence of Color Blindness in Dental Professionals: A Survey. J Dent App. 2017; 4(2): 389-391.

Table 1: Color vision status according to age group distribution of entire sample.

Age group (in years)	Color Vision Status			
	Normal		Color Vision Defect	
	No.	%	No.	%
17-21	101	97.12	3	2.88
22-26	71	97.26	2	2.74
27-31	14	87.5	2	12.5
32 and above	7	100	0	0
Total	193		7	

Table 2: Color vision status according to gender.

Color Vision Status	Gender				Total (Out of 200)	
	Male		Female			
	No.	%	No.	%	No.	%
Normal	51	91.07	142	98.61	193	96.5
Color Vision Defect	5	8.93	2	1.39	7	3.5
Total	56	100	144	100	200	100

prior theoretical knowledge about the concept of color. The study got ethical clearance from the Institutional Ethics Committee. A total of 200 dental professionals were randomly selected as subjects for the present study including 181 dental students, 17 faculty members and 2 dental technicians. The subjects included were informed about the need for the study and a written informed consent was obtained from each subject to participate in the study. A questionnaire containing information about their age, gender and designations was filled by each subject. Their color vision status was evaluated using the ISHIHARA test. Ishihara test gives a quick and accurate assessment of the color vision deficiency of the congenital origin [8]. Six color plates were shown to each subject and subjects were asked to detect the numbers in the color plates and write them in the questionnaire provided. The questionnaires were, then, evaluated and the data obtained was subjected to statistical analysis. All the standard instructions for the test were followed. The positive results were assessed for false positive findings by advanced examination using 17 color plates. Color blindness between subjects of different age groups and gender was recorded. The investigators were adjudged not to be color blind by comparing the results of the Ishihara test administered to them.

Statistical analysis

The data obtained was subjected to statistical analysis. The prevalence of color blindness, age specificity and the ratio of the occurrence of color blindness in gender were assessed statistically using IBM SPSS version 10 statistics software, Chicago, United States, with significance set at $P \leq 0.05$.

Results

The prevalence of color blindness in the sample frame was found to be 3.5% (7 out of 200 presented with color blindness). Five of the seven color blindness positive subjects were unaware about their anomaly. Most of the positive results obtained in the study were below 32 years of age (Table 1). The prevalence was more in males (8.93%) as compared to females (1.39%) giving the Male:Female ratio of 6.4:1. The Odd's ratio was calculated to be 6.908 with 95% confidence interval of 1.309 to 37.006 (Table 2). Out of 200 subjects, 1 in 17 faculty members and 6 in 181 students were found to have a compromised ability to identify colors properly while none of the dental technicians were found color blind (Table 3).

Table 3: Color vision status distribution according to designation.

Designation	Color Vision Status				Total (Out of 200)	
	Normal		Color Vision Defect			
	No.	%	No.	%	No.	%
Faculty	16	94.12	1	5.88	17	8.5
Students	175	96.69	6	3.31	181	90.5
Allied	2	100	0	0	2	1
Total	193	96.5	7	3.5	200	100

Discussion

Vision is a psycho-physical phenomenon based on the sensitivity of the cones in the retina to wavelengths between 400 to 700 nm of the electromagnetic spectrum. There are three types of cones in the eye responsible for spectral sensitivity for color perception. When a single group of color receptive cones is missing from the eye, the person is unable to distinguish colors and is said to have color blindness. A person with loss of red cones is called a protanope and in such a case, the overall visual spectrum is noticeably shortened at the long wavelength end because of a lack of the red cones. A color-blind person who lacks green cones is called a deuteranope with this person having an almost normal visual spectral width because red cones are available to detect the long wavelength red color. Red-green color blindness is a genetic disorder that occurs almost exclusively in males. Furthermore, blue-yellow type of color blindness is called tritanopia and is extremely rare. The most commonly used tests for color vision deficiencies are the Ishihara plates used for detecting red-green deficits and the Richmond HRR (Hardy, Rand and Rittler) plates which include cards for blue-yellow (tritan) deficiencies and are, also, suitable for acquired color vision defects [9]. As blue yellow deficiencies are extremely rare, Ishihara test was employed in the present study. The series of Ishihara color plates are designed to give a quick and accurate assessment of color vision deficiencies of the congenital origin [8]. However, it must be noted that the ability to grade the severity of color vision defects with pseudo-isochromatic test plates is limited [10,11] and results from such tests cannot yet be used as a basis for deciding on the severity of the compromise of the professionals [9]. Studies have shown that color blindness is common amongst dental professionals and does affect their shade matching ability [6]. In a study conducted amongst Nigerian dental practitioners, the prevalence of color blindness was found to be 6.3% and the prevalence was found to be higher in males (8.4%) than in the females (3.9%) giving a male to female ratio of 2.2:1 [4]. The findings of the present study were in agreement with this study. Barghi N et al conducted a study on 50 individuals wherein seven were found to be color blind [12]. Moser JB et al, also, conducted a similar study on 670 professionals and found 66 (9.95%) professionals to be color blind [3]. The prevalence of color blindness in the present study was found to be 3.5 and the prevalence was found to be higher amongst males (8.93%) as compared to the females (1.39%). Similar findings

were obtained in other studies wherein the phenomenon of color blindness was attributed to the fact that the defective gene for color blindness is carried on the X chromosome (within the Xq28 band) [4,6]. Wasson W and Schuman N, also, found 9.3% of the population, predominantly males, presenting with color blindness in their study signifying the sex-linked nature of this condition [13] which is analogous with the findings of the present study. Color perception plays an important role in dental profession. It involves a balanced interaction of the illuminant, object and observer. Unfortunately, not many of the professionals are aware of their ability for color perception [9]. The purpose of the present study was to make dental professionals aware about their anomaly, if, it existed and to create awareness about this type of compromising ability which is useful in pursuing a successful career in dentistry.

References

1. Gokce HS, Piskin B, Ceyhan D, Gokce SM, Arisan V. Shade matching performance of normal and color vision-deficient dental professionals with standard daylight and tungsten illuminants. J Prosthet Dent. 2010; 103: 139-147.
2. Landini G, Perryer G. Digital enhancement of haematoxylin and eosin stained histological images for red-green color-blind observers. J Microsc. 2009; 234: 293-301.
3. Moser JB, Wozniak WT, Naleway CA, Ayer WA. Color vision in dentistry: a survey. J Am Dent Assoc. 1985; 110: 509-510.
4. Bamise CT, Esan TA, Akeredolu PA, Oluwatoyin O, Oziegbe EO. Color vision defect and tooth shade selection amongst Nigerian dental practitioners. Rev Clín Pesq Odontol. 2007; 3: 175-182.
5. Poljak-Guberina R, Celebic A, Powers JM, Paravina RD. Color discrimination of dental professionals and color deficient laypersons. J Dent. 2011; 39: e17-22.
6. Khosla A, Maini AP, Wangoo A, Singh S, Mehar DK. Prevalence of Color Vision Anomalies Amongst Dental Professionals and its Effect on Shade Matching of Teeth. J Clin Diagn Res. 2017; 11: ZC33-ZC6.
7. Davison SP, Myslinski NR. Shade selection by color vision-defective dental personnel. J Prosthet Dent. 1990; 63: 97-101.
8. Ishihara S. Ishihara's Tests for Color Blindness. London: Hodder Arnold. 1998.
9. Mushtaq F, Baraas RC, Al-Saud LM, Mirghani I, van der Zee C, Yates E, et al. Should prospective dental students be screened for color vision deficits? Br Dent J. 2016; 221: 227-228.
10. Barbur JL, Rodriguez-Carmona M. 2 – Variability in normal and defective color vision: Consequences for occupational environments. In J Best (Ed). Color Design. 2012; 24–82.
11. Cole BL. Assessment of inherited color vision defects in clinical practice. Clin Exp Optom. 2007; 90: 157-175.
12. Barghi N, Pedrero JA, Bosch RR. Effects of batch variation on shade of dental porcelain. J Prosthet Dent. 1985; 54: 625-627.
13. Wasson W, Schuman N. Color vision and dentistry. Quintessence Int. 1992; 23: 349-353.

J Dent App - Volume 4 Issue 2 - 2017
ISSN : 2381-9049 | www.austinpublishinggroup.com

Citation: Sanjay N, Budhiraja Sakshi M, Komuravelli Anil K, Khandelwal Rownak O and Nayyar AS. Prevalence of Color Blindness in Dental Professionals: A Survey. J Dent App. 2017; 4(2): 389-391.