Strabismus and Color Vision Evaluation in Dentistry Students

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Abstract

Dentists have long close work and require good stereopsis. In addition, cosmetic dental surgery is increasing. The objective of this research was to estimate the prevalence of ahedan University of Medical Zstrabismus and color vision disorders in dental students of Sciences.This cross-sectional study was conducted from January to May 2013.A total of 104 students participated in this research. All participants underwent an ophthalmological assessment including visual acuity testing with Snellen E-chart and Objective refraction by auto refraction. Cover test was conducted at distance and near with and without correction.Color Blindness was examined with the Ishihara's test. Analyses were done by SPSS software (ver. 11.5). The probability value less than 5% were assumed statistically significant. In all, 51(49%) subjects were males. Participants' age was in the range of 20 to 40 years old. A total proportion of about 75% had Exophoria. Strabismus type and gender indicated no substantial correlation (P=0.76). Intermitantesotropia, Esotropia and Hyperphoria the minimum observations in total. 5.8% of students also had color vision defect. Generally, optometrists assess strabismus and color vision defect routinely in clinical examinations. This could help in the early diagnosis the disorders.

KEYWORDS: Color vision defect, strabismus, cover test, dentist

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1. Introduction

Strabismus is the abnormal alignment of the visual axis of both eyesor the disability to focus the eyes of the different directions (Kommerell& Kromeier,2002)

The two primary types of ocular deviations are the heterotropia and the heterophoria. When a high degree of heterophoria occurs, there might be suppression and a high stereoscopic threshold, but motor responses are adequate to keep the eyes aligned (Makgaba, 2006) Both heterophoria and hetrotropia can be vertical, horizontal oroblique (cyclophoria). Based on the literature, a small heterophoria exists in 70-80% of the population (Kommerell& Kromeier,2002) and heterophoria have distinct effects on stereo acuity depending on whether it was in the Esophoria or Exophoria(Saladin, 1995).Strabismus causes difficulty in close works and effects on stereopsis. Thus, accurate detection intervals are difficult. These issues are crucial for near vision occupations especially dentists.

Several studies have indicated that visual discomfort symptoms are common among thosesubjects who have lengthy near tasks (Sheedy, Hayes, &Engle, 2003; Evans, B. J. W. 2005; Chase, Tosha, Borsting, &Ridder, 2009)and symptoms might includeeye strain, photophobia, headache, decreased stereopsis, blurred vision and lack of concentration while doing close works,diplopia, poor visual performance and/or dizziness which results from vertical heterophoria18. These symptoms often have a negative effect on academic performance. 56.2% of referred subjects with these mentioned symptoms also had Binocular dysfunction (Montés-Micó, 2001).

Color blindness, or color vision deficiency (CVD), is another notable factor which can influence dentists' performances (Wasson &Schuman,1992). CVD is the inability or decreased ability to recognize color distinctions under normal lighting conditions. CVD can be categorized as congenital or acquired. John Dalton was the leading pioneer of the color blindness research in1798 (Naresh, 1995; Fareed, Anwar,& Afzal, 2015; Deeb, 2006).

Red-Green defects (Protan and Deutan) present the highest prevalence in the general population (Citrik, Acaroglu, Batman, &Zilelioglu, 2005).

The prevalence of color blindness differs among distinct ethnic populations worldwide. It was shown that deutan, protan, and achromatic had more frequencies, respectively (Fareed, Anwar,& Afzal, 2015) CVD is a X- linked recessive inheritance. Hence, it happens in males, but is transmitted via females. About 8% of all females are carrier of that (Guyton & Hall, 2005).

Color vision deficiency is a drawback especially for employment opportunities such as pilots, engineering, and medical professions like dentistry (Naresh, 1995;Niroula&Saha, 2010). The capabilityof the dentists to match colors and shades accurately and precisely is a substantial component of restorative dentistry(Wasson &Schuman,1992).A number of studies have proposed that color-vision screening for dentistry students and practitioners could stop negative consequences for both the patient and practitioner(Wasson &Schuman,1992). Dentists have long close work and require good stereopsis. In addition, cosmetic dental surgery is increasing. In general, the lack of examination and treatment provides social limitations and constraints in dentistry.

The objective of this research was to estimate the prevalence of strabismus and color vision disorders indental students of Zahedan University of Medical Sciences.

2.METHODS

2.1.Study design / Setting

This cross-sectional study was conducted ondentistry students of Zahedan university of medical sciences, located in the southeast of Iran,from January to May 2013.A total of 104 dentistry students participated in our research through random sampling method from students' list of Vice- Chancellor for Academic Affairs of the university. The inclusion criteria were IOP less than 21 mmHg, no history of trauma and ocular surgery, no pre-existing ocular pathology, and no usage of any ocular or systemic medication that might affect the eyes. These criteria were evaluated by a checklist and rechecked by an optometrist.

2.2.Data collection

A sample size of 104 subjects computed for a two-sided 95% confidence interval for proportion with 0.1 precision (Fleiss, Levin, & Paik, 2003). Demographic information and clinical records of all subjects were recorded. All participants underwent an ophthalmological assessment including visual acuity testing with Snellen E-chart under standard light condition at a distance of 4 m. Objective refraction were examined by auto-refraction (Topcon Auto ref-keratometer, RM8800, Japan,http://www.topcon-medical.eu) and static retinoscopy (Heine Beta 200 retinoscope, HEINE Optotechnic, Germany, http://www.heine.com)was done to check the findings.Refractive error degree was recorded as spherical equivalent (SE). SE value computed as sphere + 1/2 cylinder. Myopia was defined as an SE $\leq$ -0.5 diopters (D), hyperopia as SE $\geq$0.5 D, and emmetropia as SE from - 0.5D to +0.5D (Hashemi et al., 2014). Several methods are used clinically to evaluate strabismus. Initially, fusion must be broken to achieve dissociation of the eyes, letting evaluation of heterophoria (Goss, 1995).

Cover test was conducted at distance and near for assessment strabismus with and without correction. To control accommodation and fixation, the subjects were asked to look at a letter from the line above the best visual acuity of the weaker eye.First, unilateral cover test was implemented to betray any type of heterotropia. After that, alternate cover test was conducted for investigation and measuring other ocular deviations at distance and near(Friedman et al., 2009).

CVD was examined with the Ishihara's test ("Ishihara Type Tests for Color Blindness"-38 plates (1990) Eye Care- Ludhiana, India). Subjects were asked to seat in a room with standard light and read the chart in 33 cm away from their eyes. The types of color blindness were determined using the chart guideline (Makgaba, 2006).

2.3.Statistical analysis

Data cleaning was performed after data collection phase. Descriptive characteristics by gender represented in a frequency distribution table. The distribution of strabismus and color vision, as the main variables of interest, showed as the observed number and their percent in each category. Pearson's correlation coefficients calculated for bivariate relations. Finally, multiple logistic regression was used to evaluate the associations of some probable predictors with strabismus.

3.RESULTS

There were 51(49%) males and 53(51%) females in this research. Participants' age was in the range of 20 to 40 years old. Table 1 indicates summary statistics for age and refractive error type by gender. There was only one case in each myopic and hypropic astigmatism categories for males. We found no observation in hypropic astigmatism and female combination cell. Plano subjects allocated higher proportion of sample in both male and female groups. There was no significant relationship between age and refractive error type with gender (P>0.05).

Table 1. Descriptive characteristics for the study sample by gender (n=104)

		Gender			
		Male (n=51)	**Female (n=53)**	**Total**	**P**
Age (year) Mean (SD)		24.6 (4.3)	23.5 (3.2)	24 (3.8)	0.15
Refractive error n (%)	Myopia	1 (2)	6 (11.3)	7 (6.7)	0.82
	Hyperopia	2 (3.9)	2 (3.8)	4 (3.8)	
	Astigmatism	9 (17.6)	7 (13.2)	16 (15.4)	
	Myopic astigmatism	8 (15.7)	8 (15.1)	16 (15.4)	
	Plano	30 (58.8)	30 (56.6)	60 (57.7)	
	Hypropic astigmatism	1 (2)	0 (0)	1 (1)	

Table 2 shows the distribution of strabismus and color vision of the subjects. A total proportion of about 75% had exophoria. Strabismus type and gender indicated no substantial correlation (P=0.76). Intermitantesotropia, Esotropia, andHyperphoria the minimum observations in total and in both males and females. In general, about a high proportion of subjects (88.5%) with 95% confidence interval (CI): (81.7%, 94.2%) experienced one of the strabismus defections. 5.8% with (95% CI: 1.9%, 11.6%) of dentistry students also had color vision defect.

Table 2. Frequency distribution of strabismus and color vision parameters for sample by gender (n=104)

		Gender			
		Male (n=51)	**Female (n=53)**	**Total**	**P**
Strabismus n (%)	EXO	10 (19.6)	15 (28.3)	25 (24)	0.76
	IXT	17 (33.3)	14 (26.4)	31 (29.8)	
	XT	12 (23.5)	10 (18.9)	22 (21.2)	
	ESO	4 (7.8)	6 (11.3)	10 (9.6)	
	IET	1 (2)	0 (0)	1 (1)	
	ET	1 (2)	0 (0)	1 (1)	
	HYER	1 (2)	1 (1.9)	2 (1.9)	
	ORTHO	5 (9.8)	7 (13.2)	12 (11.5)	
Color vision n (%)	No defect	46 (90.2)	52 (98.1)	98 (94.2)	0.11
	Protane	4 (7.8)	1 (1.9)	5 (4.8)	
	Deutrane	1 (2)	0 (0)	1 (1)	

Bivariate correlation analysis revealed a significant relationship between refractive error type and having strabismus (P=0.01). On the other hand, no relation between gender and color vision (P=0.11), gender and strabismus type (P=0.76), and age with strabismus (P=0.63) were detected. Logistic regression modeling through backward elimination variable selection method indicated a considerable odds ratio (OR = e^{β} = 0.10; 95% CI = (0.01, 0.84)) for refractive error type on having strabismus as the outcome. Thus, for a non-emmtropic subject, the odds of having strabismus are 10 times larger than the odds for an emmetropic individual having strabismus.

4.Discussion

Binocular vision disorders (BVD) such as strabismus have high prevalence and effects people's quality of life (Maino, 2010). Exotropia is more frequent in the middle-east and east of Asia while esotropia is more frequent in England, Canada, Australia, Finland, and the US (Yektaet al., 2012). We achieved the same results in our study. Several studies have shown that visual discomfort symptoms are frequent among those cases who have lengthy near task such as, using a computer or reading and complaints might include visual fatigue, diplopia, headache, blurred vision, loss of concentration, light sensitivity, or perceptual distortions involving letter movement and fading(Cacho-Martinez et al., 2015; Yekta et al., 2010).

Different findings in distinct studies might be due to the different study populations, type of study, criteria followed to define disorders, and/or patients' age (Yekta et al., 2010).

In the present study, most of the subjects had exophoria (n=56; 53.8%), followed by orthophoria (n=12; 11.5%) and then esophoria (n=11; 10.6%). Our results were supported with the authors who reported that there is a high prevalence of near exophoria.(Mathebula, Sheni, &Oduntan, 2002; Makgaba, 2006)

Several studies indicated that there is a relationship between heterophoria and age (Yekta, Pickwell, & Jenkins, 1989; Makgaba, 2006). The findings in the present study, however, indicated that there was no correlation between heterophoria (vertical and horizontal) at distance and near with age. This may be due to the limited age range in our study. Therefore, there is a need to perform heterophoria measurements on every patient (symptomatic or asymptomatic) because in some asymptomatic patients, symptoms may occur after extended near work especially if the relevant compensatory mechanism is not very high (Makgaba, 2006).

Although color vision is a key factor of restorative and esthetic dentistry, but it is not tested for this sensitive job group at any time during their period of tasks. CVD differs according to race, genetic, and geographical (Shah, Hussain, Fareed, & Afzal, 2013).Our study showed that the total prevalence of CVD was 5.8% with a noticeable male preference. 9.8% of the males and 1.9% of the females presented CVD. Red-green color blindness (Protan and Deutan) display the highest prevalence in the general population (Niroula&Saha, 2010).The frequency of red-green color blindness in males of Libya (2.2%), Nepal (3.9%), Jordan (8.7%), Singapore (5.3%), Thailand (5.6%), Turkey (7.3%), Korea (5.9%), Iran (8.1%), Saudi Arabia (2.9%), and Eastern India (8.73%) were found higher than females (Fareed, Anwar,& Afzal, 2015). We reported the prevalence of CVD in females in addition to males.

The frequency of CVD in the present study, importance of color matching in dental treatments, and unawareness of this defect by most affected subjects have made color vision tests a necessity. The capabilityof the dentists to match colors and shades accurately and precisely is a substantial factor in restorative dentistry. A number of studies have proposed that color-vision screening for dentistry students and practitioners could stop negative results for both the patient and practitioner. Dentists have long close work and require good stereopsis. In addition, cosmetic dental surgery is increasing. In general, the lack of examination and treatment provides social limitations and constraints in dentistry (Wasson &Schuman,1992).

If a CVD is detected early in a dental student, he or she can be taught color principles and clinical applications in restorative procedures. Generally, optometrists assess strabismus and CVD routinely in clinical examinations. This could help in the early diagnosis the disorders.

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