

A study on color blindness among dentistry students of Kerman medical university

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ABSTRACT

Background and aim: Color Blindness is decreased ability to see or differentiate colors. The disorder can interfere in some educational activities such as dentistry. Due to much difference in the prevalence and lack of study in the region, this study was conducted in dental students of Kerman Medical Sciences. **Materials and Methods:** In this cross sectional study, 209 male and 242 female students of kerman dental school in the academic year of 2017- 2018 were examined by Ishihara test. Data collection was conducted through questionnaires and test color. Data analysis had been done with Chi square, ANOVA and independent T-test methods. **Results:** In this study from 451 students, 120 (26.6%) students were color-blind that 65 of them (14.4%) were males and 55 (12.2%) were females. Among 120 cases of blindness, 50 cases were green, 33 cases were red-green and 37 cases had color disorder. **Conclusion:** The findings showed that the rate of blindness was higher in the study population than other regions and prevalence of the disorder in men was higher than women.

Keywords: Color blindness, Ishihara, descriptive, dentistry students.

Introduction

Colorblindness is a condition in which the ability to perceive and recognize colors decreases. The colorblindness can negatively impact some educational activities. The light that beams from the objects to human eye stimulates the retina's sensitive cells including cone (sensitive to colors) and rod (sensitive to lights) [1]. The produced impulses pass through the optic nerve and find their way to the brain where the colors are analyzed and recognized. Therefore, any issue in this path leading to the lack of understanding and vision, can compromise the color recognition [2]. One of these conditions are called

colorblindness that make the person unable to perceive some colors. This genetically inherited disorder's rate in men is 8% which stands higher than women [3]. This condition has been seen in three categories [4]:

1. Anomalous (non-sensitive to colors)
2. Dichromatic (non-sensitive to two primary colors. Usually red and green are not understood)
3. Trichromatic anomalous (non-sensitive to all three primary colors and deficiency in one of the main pigments in cone cells of retina.

Colorblindness is a genetic disorder and most of its types are related to X chromosome. It is more common in men than women as allele is recessive. It happens in women whose both X chromosomes have deficiency [5]. Colorblindness can also happen due to physical and chemical injuries to the eyes, optic nerve or parts of brain. There is no treatment for colorblindness [6]. However, we can enhance the color vision, using wearable system based on augmented reality devices [7]. Ishihara color test is usually a diagnostic method. Other methods are used as well, however [8]. The ability to perceive colors decreases by aging [9].

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The most common colorblindness is the Green-Red type. That is seen 8% in men and 5% in women. Consequently, we have Blue-Yellow (tritanopia) that has the same rate in men and women, afterwards [1, 4, 9]. Protanopia, deuteranopia, protanomaly and deuteranomaly are the commonly inherited red-green colorblindness types that affect a considerable percentage of population [10]. To make a beautiful restoration we need morphological, optical and biological aspects of beauty in addition to choosing the right sort of colors which are the important points in achieving this goal.

The source of light, the object and the observer, are all the impacting factors in color recognition. [11]. Regarding the importance of choosing colors in dentistry, different opinions about the factors which impact the subject and the fact about the importance of perceiving colors in prosthesis and restoration fields and the fact about the importance of the beauty to the patients, the objective of this research is to study the colorblindness in dentistry students in Kerman Medical University in 2017-2018 educational year according to age, gender and the type of colorblindness.

Material and Methods

In this descriptive study, all the dentistry students of Kerman Medical University were included. This study was approved by the Ethics Committee of Kerman University of Medical Sciences (Code: IR.KMU.REC.1396.1761). Among of these students 199 were male and 252 were female. Ishihara was the method which was used. The descriptive – analytic and cross sectional method was based on the study conducted by Khodadadi and Sadeghi in 1389 on medicine students of Isfahan Medical University [12]. The census method was used to choose the subjects and the lists of medical students of all the years of entry was requested from education office. The data was collected through filling questioners and Ishihara color test was given. Questioners included two sections. One section was about demographic information such as age and gender and the other section indicated the result of the color test. The color test was given using the Ishihara’s color test booklet, which is one of the reliable tests that Iranian ophthalmologists refer to. The booklet contains 12 pages including a test which gives a quick and accurate assessment of color vision deficiency. On each page there is a colorful number in English surrounded by colorful shapes. The correct recognition of the number depends on the ability of identifying colors in maximum of 3 seconds. At first, the examiner was tested for colorblindness and then was educated to learn how to use the booklet. Next the test was given individually to all the students. The images were placed vertically, 75 centimeters away from the participants. The analysis of the answers or the true or false number on the cards was done according to the booklet’s instruction. In order to have a precise analysis of the test, the images were shown in a room with normal day light; since trying this test under sunlight or yellow lights is not recommended as the colors can change significantly and the subject may have a different understating of them. After the entry stage of data, the data was analyzed by

SPSS software (ver.21). The Frequency and the frequency percentage were used to indicate qualitative data and the average of the standard deviation were used to indicate quantitative data. Qualitative variants were analyzed using Chi Square and quantitative data were analyzed using ANOVA and Independent T-Test. The meaningful (acceptable) level in all the tests was 95% [13].

Results

451 people participated in this study which 209 (46.3%) of them were male and 242 (53.7%) were female. The age range was between 18 and 31 with the average of 23.87. The average age in men was 22 ± 2.61 and in women 24.08 ± 2.74 . There was no considerable difference between the age of men and women ($p = 0.7$).

Amongst the 331 (73.4%)120 people (26.6%) were color blind. Of the color blind people 11.09% were green blinded, 7.317% were red-green blinded and 8.204% had color disorder (figure 1).

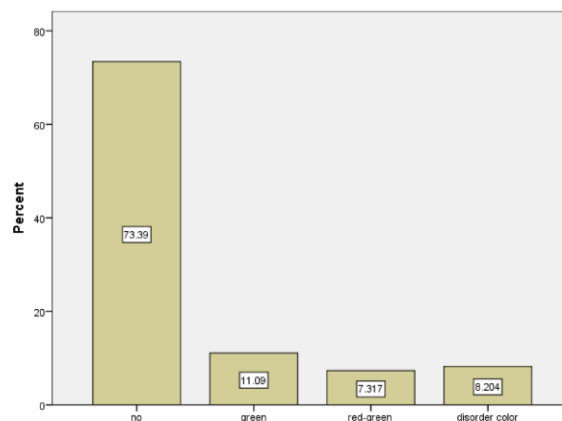


Figure 1: Percent of Healthy people and all kinds of Blindness people

The healthy participants had an average age of 23.95 and the color blind participant's average age was 23.65. There was no meaningful difference between age and colorblindness. According to gender and colorblindness, the result showed that the rate of colorblindness in men is higher than in women ($P=0.04$) (Table 1).

Table 1: Frequency (Percent)of Blindness according to sex

| Blindness \ Sex | sex | | | *P Value |
|-----------------|-------------|-------------|-------------|----------|
| | False | True | Total | |
| Man | 144 (43.5%) | 65 (14.4%) | 209 (46.3%) | 0.04 |
| Woman | 187 (41.5%) | 55 (12.2%) | 242 (53.7%) | |
| Total | 331 (73.4%) | 120 (26.6%) | 451 (100%) | |

The frequency percentage of the most common type of colorblindness was green colorblindness (41.7%) and after that it was color disorder (30.8%) and the least common was red-

green colorblindness (27.5%). The mean age of green, red green, and color disorder was 23.56 ± 3.0 , 24.18 ± 2.9 and 23.30 ± 2.8 respectively. There was no meaningful difference between the age and the types of colorblindness ($p=0.44$).

The colorblindness frequency in men and women is shown in figure 2 and the relationship between the types of colorblindness and gender is shown in table 2.

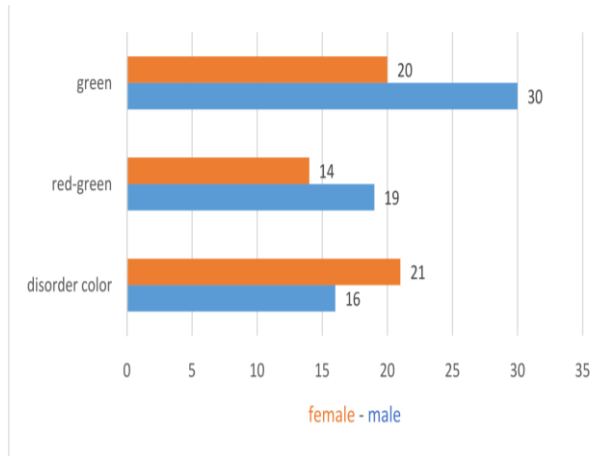


Figure 2: Frequency of Blindness according to type of Blindness

| Sex Blindness | Man | Woman | Total | P Value |
|----------------|------------|------------|------------|---------|
| Green | 30 (25%) | 20 (16.7%) | 50 (41.7%) | 0.82* |
| Red-Green | 19 (15.8%) | 14 (11.7%) | 33 (27.5%) | 0.23** |
| Color disorder | 16 (13.3%) | 21 (17.5%) | 37 (30.8%) | 0.12*** |
| Total | 65 (54.2%) | 55 (45.8%) | 120 (100%) | 0.27 |

There was no significant difference between the types of colorblindness and gender. The most common colorblindness in men was green and in women it was color disorder.

Discussion

The observer's color perception plays an important role in the shade selection [14]. There are other elements that impact the recognition of colors and objects such as: age, experience, fatigue, surrounding colors, source's light, background etc.... for example, in a study it was shown that when shade matching light by corrected light device and pink background were used, we had an increase in the reliability of shade selection [15]. Also it was shown in Bahannan and colleagues study that normal male and female subjects, got better results in shade matching when used the shade matching device (Easy Shade Compact), comparing to conventional visual method [16]. In Pecho's study of gender female observers also showed better accuracy on visual shade matching than male observers [17]. In Kholsa's et al study conduct in India the prevalence of color vision anomalies and its effect on matching the shades of teeth evaluated and due to it's defects in color vision they do not have a significant effect on the accuracy of shade matching of teeth [18].

The current study was conducted through cross sectional and analytical data collection through questionnaire and Ishihara's color test. This was similar to Khodadadi's study. [12] Considering the other two studies conducted by Haseeb Alam in Karachi and regarding their variants such as education, job, age, social rank and race. We learn that there was no significant relationship between these elements and colorblindness. This disorder is in fact a genetic deficiency and not significantly related to inherited cases [19].

This study shows that women with no colorblindness had the highest frequency (187 cases or 41.5 % of the assessed population). Women with green-red colorblindness had the lowest frequency (14 cases, 11.7%). 41.7% had Deuteran Anomaly (green blinded), 27.5% had Proton anomaly (red blinded) and 30.8% had color disorder. In Bagherzadeh and colleagues study which was presented in 1385, 74% were green blinded, 25% red blinded, which is similar to the recent study results [20].

As mentioned before, obtained statistics showed that colorblindness is less common in men than women. Men possess a higher percentage in green blindness. Also, the study that was done in The American Dental Association showed that this deficiency has significantly different figures in male and female dentists. 1% in women and men 8.9% [8]. However the results of the other study that was done by Bamis and colleagues was in conflict with our results. This means that it showed colorblindness is more common among women (9.3%) comparing to men. (4.8%) [4] The methods were different in these two studies and that may justify the different results. In Bamis study Ishihara method was not used and also the subjects race was different, that's why it ended up showing different results. In this study we mentioned that there is no significant relationship between colorblindness and subjects' age. The results of Haseeb Alam and Shreshka RK are similar to the results of the present study [19, 21].

Conclusion

According to the above discussion we can conclude that colorblindness runs differently in different societies. Also the frequency of this disorder was high among the studied pollution (26.6%). Other studies showed that this disorder is more common in men comparing to women. This study's results also show that colorblindness is more common in men and there was a significant relationship between colorblindness and gender. Regarding the fact that our study group were dentistry students and no study of this nature was conducted before on dentistry students of Kerman, it is concluded that this perspective study can be a useful suggestion from the future's point of view. We can use the results of this study to prevent the possible mistakes in dentistry.

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