Acta Scientific Dental Sciences (ISSN: 2581-4893)

Volume 7 Issue 3 March 2023

Research Article

Effect of Gender and Experience on Shade Matching-A Comparative Evaluation

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DOI: 10.31080/ASDS.2023.07.1585

Received: January 23, 2023

Published: February 12, 2023

Abstract

Shade selection critically dictates clinical success of fixed prosthesis. There are a few factors that can influence the shade selection like the illuminating light sources, gazing at colored cards before shade selection, clinical experience of the operator who selects the shade and the gender of the operator. In the Indian context, there are very few studies that critically evaluates the influence of clinical experience of the professional who does the shade selection and the role of gender. While comparing Professors, PG students and interns for their shade matching ability, professors performed better than the other two groups. Female operators performed better than the male operators but the difference was not statistically significant.

Keywords: Shade Selection; Illuminating Lights; Gazing at Colour Cards; Gender; Experience

Introduction

Tooth or implant supported fixed restorations gain aesthetic excellence when their shade match with that of the adjacent teeth. Correct identification of the tooth shade is the first step and that greatly depends on the observer, the illuminating light source, the object which is subjected to shade determination and the tool used for identification of the shade. Tooth has a complex structure and each element contributes substantially towards the colour. The shade guides usually help the operator to determine the shade of the tooth but very often subjective errors creep into the decision making of colour. Nitin et al. after conducting a detailed evaluation on light sources, conditioning of the eye with colour cards and two different shade guides have come to the conclusion that sunlight is the most ideal source of illumination followed by colour corrected light and halogen lamp. Gazing at neutral gray and blue cards can serve as effective adjuncts in colour determination. On the tool front, Vitapan 3D master was superior to Vitapan Classical shade guide [1].

In the past, the individual who determines the shade was also a subject of evaluation. It is generally believed that women are more efficient in identifying the colour correctly. The scientific evidence has very often challenged this statement. Probably this has to be viewed in the context of colour vision deficiency (colour blindness) which is very prevalent amongst men. Global statistics indicate that one in twelve males suffer from this deficiency whereas only one in two hundred females has the colour vision defect [2]. While comparing individuals of both the genders, some authors have found no significant difference in their colour distinguishing efficiency [3-5]. The conflicting opinions require an indepth evaluation inclusive of professionals with different experience too. About experience also there are opposing opinions. Few authors feel that experience has a role while others feel that experience does not matter at all [6,7].

In this context, it was decided to find out (1) whether gender is an influencing factor in finding out the correct shade of tooth (2) whether the clinical experience has a significant role in the process of shade matching.

Methodology

24 volunteers were selected belonging to three categories of professionals viz. Professors (8), PG Students (8) and Interns (8).

In each group, males and females had equal representation. Distribution of volunteers are given in table 1.

Category of Volunteers	Number of males	Number of females
Professors	4	4
PG Students	4	4
Interns	4	4
Total	12	12

Table 1: Distribution of volunteers participated.

All the volunteers were screened for the presence of colour blindness using Ishihara's test (Kanehara and Co Ltd, Japan) (Figure 1,2). Volunteers were asked to identify the shades of specimens consisting of two selected shade tabs from Vitapan Classic and Vitapan 3D master, two fabricated discs of feldspathic porcelain (Duracem plus, Germany) and two discs of pressable ceramics (Ivoclar IPS e.max Ceram, Liechtenstein) (Figure 3). Another set of specimens were made with shade difference for a second evaluation. Fabricated specimens were reevaluated for the correctness of shade using Spectrophotometer (Vita easy shade advance). Distribution of specimens is given in table 2. Each volunteer was asked to evaluate the shade under five different light sources viz. Sun light, Incandescent bulb, fluorescent tube, Halogen bulb and Colour corrected lamp (5500^0K) [1].

Figure 1: Ishihara's test.

Figure 2: Ishihara's colour vision testing plates.

Figure 3: Specimens used for colour matching.

Group	Specimen No.	Description
I	1	A2 of Vitapan Classic shade guide
	2	C2 of Vitapan Classic shade guide
	3	Disc of feldspathic porcelain matching to A2
	4	Disc of pressable ceramic matching to A2
	5	Disc of feldspathic porcelain matching to C2
	6	Disc of pressable ceramic matching to C2
II	7	2M2 of Vitapan 3D Master shade guide
	8	4L1.5 of Vitapan 3D Master shade guide
	9	Disc of feldspathic porcelain matching to 2M2
	10	Disc of pressable ceramic matching to 2M2
	11	Disc of feldspathic porcelain matching to 4L1.5
	12	Disc of pressable ceramic matching to 4L1.5

Table 2: Distribution of specimens used.

Two different shade guides - Vitapan Classic and Vitapan 3D master - were used by each volunteer (Figure 4). Appropriate rooms and working conditions were provided (Figure 5-7) according to Nitin., *et al.* [1].

Tabular forms were provided where the volunteers were instructed to fill up the shade selection. Results obtained from the study were subjected to Logistic regression/Log linear analysis and Chi- squared test to find out the differences between each group and for statistical significance. The methodology is summarized in the flow chart (Figure 8).

Figure 4: Vitapan 3D master and Classic shade guides.

Figure 5: Male volunteer - Professor.

Figure 6: Male volunteer - PG student.

Figure 7: Female volunteer - Intern.

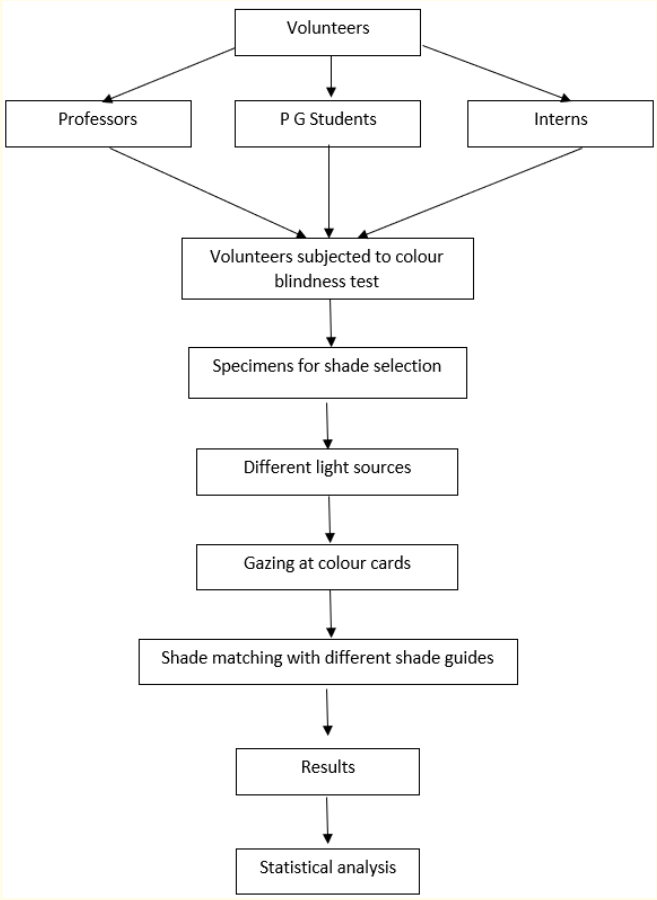

Figure 8: Flow chart on methodology.

Results

Consolidated results of the present study are given in the graphical representations (Figure 9-14). Percentage of correctness in shade determination under variable conditions of illumination, specimens, shade guides obtained by volunteers belonging to different genders and experiences are given in the graphs. The statistical analysis was performed using the logistic regression/log linear analysis and the Chi-squared test.

Figure 9: Correct identification of shade of Feldspathic specimens using Vitapan 3D master (%).

Figure 10: Correct identification of shade of Feldspathic specimens using Vitapan Classic (%).

Figure 11: Correct identification of shade of pressable ceramic specimens using Vitapan 3D master (%).

Figure 12: Correct identification of shade of pressable ceramics using Vitapan Classical (%).

Figure 13: Correct shade identification of shade tab specimens using Vitapan 3D master (%).

Figure 14: Correct shade identification of shade tab specimens using Vitapan Classical (%).

The three different groups of volunteers based on the experience viz. Professors, PG students and Interns were found to be a significant factor in influencing the correct identification of shade ($P < 0.001$). However, PG students (OR = 0.76) and interns (OR = 0.89) had lower odds/chances of identifying the right shade when compared to professors.

Gender was not found to be a significant factor in influencing the correct identification of shade ($P > 0.05$). However, an odds ratio of >1 obtained for females (OR = 1.09) denotes that females have 9% higher chance of identifying the right shade in comparison to the males. (Table 3).

Variables	β	SE of β	df	P-Value	Odds Ratio	95% CI for Odds Ratio	
						Lower	Upper
Volunteers							
Professors					1§		
PG students	-0.28	0.08	1	<0.001*	0.76	0.65	0.89
Interns	-0.12	0.08	1	0.135	0.89	0.76	1.04
Gender							
Male					1§		
Female	0.08	0.06	1	0.198	1.09	0.96	1.23

Table 3: Difference between the factors Viz. Experience of volunteers and Gender, in correctly identifying the shade: (Logistic Regression/Log Linear analysis).

§ Reference Category

*Denotes significant difference

Associations observed with Chi-squared test

Various factors were further analyzed using chi-squared test and it was found that certain light sources and color card gazing had successful association with genders and it is given in table 4.

Association	P value	Gender-correctly identified the shade
Fluorescent light without any card gazing	P < 0.05	Male
Halogen lamp with blue card gazing	P < 0.05	Male
Incandescent light with grey card gazing	P < 0.05	Female
Colour corrected light with grey card gazing	P < 0.05	Male
Sunlight without card gazing	P < 0.01	Female
Halogen light with grey card gazing	P < 0.001	Female
Incandescent light without any card gazing	P < 0.05	Female

Table 4: Association of factors and the gender that performed better in correct shade identification.

Discussion

As part of an experiment, when a group of people were asked to list the colours they could remember, it was found that women could remember more colours than men [8]. It is generally believed that women have a superior ability to distinguish and remember colour. However, this is not universally accepted and many experiments have found that there is a fair gender equality in the matter of colour perception [4,9]. In normal colour vision individuals, no

significant distinction is found between males and females. However, this has to be viewed in the context of the low incidence of colour vision deficiency reported in many surveys conducted all over the world. This is also a genetically linked deficiency [2,3]. In the present study, gender was not found to be a significant factor in influencing the correct identification of shade ($P > 0.05$). However, an odds ratio of >1 obtained for females (OR = 1.09) showed that females had a 9% higher chance of identifying the right shade when compared to males. An interesting association of factors was revealed while analysing the results (Table 4). Fluorescent light without any card gazing, halogen lamp with blue card gazing and color corrected light with grey card gazing worked well with male volunteers in getting correct identification of the shade. Whereas for female volunteers, incandescent light with grey card gazing, sunlight without card gazing, halogen light with grey card gazing and incandescent light without any card gazing worked reasonably well in the successful identification of the shade. This could be considered as a possible guideline which can be adopted in the case of Indian individuals. However, the superiority of sunlight should be recognised as an important factor.

Age of the person who evaluates the shade can influence the judgement because the perceived image will be yellowish and brownish with advancing age. Diseases like diabetes and Age-related macular degeneration can have a significant influence on the shade selection [10]. Professional expertise gained with qualifications and advancing age is always considered as a superior quality in our society. Shade matching accuracy is not gained much with professional experience according to many reported studies [4,11]. Hammad [13] reported that prosthodontists demonstrated significantly superior intra-rater repeatability of shade matching than general dentists. In contrast to those observations, the present study which has a volunteer/observer strength of Professors, PG students and Interns provided ample evidence that experience do matter. Observer was a significant factor in influencing the correct identification of shade ($P < 0.001$). Post-graduate students (OR = 0.76) and interns (OR = 0.89) had lower odds/chances of identifying the right shade when compared to that of the Professors (Table 3). There is a specific hirearchy maintained in the selection of volunteers – interns, postgraduate students and professors who participated in the study. The accuracy of shade matching improved with the hierarchical position. (OR- Odds Ratio).

Conclusions

An experienced dental operator can match the shades correctly than a novice. Professors could match the shades much better than the post-graduate students and interns. Female volunteers performed better than males in identifying the correct shade. However, the difference between the genders was not statistically distinguishable.

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