

# Accuracy and Reliability of Visual Shade Color Discrimination by Men and Women in Comparison to Digital Shade Selection: A Comparative Study

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## ABSTRACT

**Aim and objective:** Compare the reliability and accuracy of shade selection done by the male observer and female observer with a digital shade matching device.

**Materials and methods:** Tooth color was measured in 39 volunteer's maxillary right and left central incisor teeth with Vita classic shade guide by two different observers (male and female) against a digital shade matching device (Vita Easyshade compact). L, C, and H values and  $\Delta E$  value determined by visual method using Vita classic shade guide against digital shade matching system (Vita Easyshade compact). ANOVA and Bonferroni multiple comparison statistical analyses were used to compare the data.

**Results:** There was very little significant difference between shade selected by male and female observers against Vita Easyshade compact with respect to L, C, and H value ( $p < 0.001$ ).  $\Delta E$  shows a significant device difference where Vita Easyshade compact has the highest mean of 3.113 followed by Vita classic has least mean value of 2.475.

**Conclusion:** Determining the shade of a tooth demands clinical skills and experience. The females achieved better results in terms of shade selection as they are more conscious about esthetics.

**Keywords:** Dental shade guides, Easyshade compact, Esthetic dentistry, Shade matching, Vita classic shade guide.

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## INTRODUCTION

Woody Allen once wrote a humorous essay entitled "What if the impressionists were dentists, then the whole play deals with a parody on the life of the impressionist".<sup>1</sup> Dentists are doctors of the mouth but from the last three decades, their final work is judged by the level of their artistic talents. Now, most dentists have such innate skills, and increasing the level of predictability and evidence into the subjective field of esthetic is the solution for dental clinicians today.

Esthetic consciousness in the present generation regarding color and appearance is quite significant and they are highly knowledgeable about the consequences of the same. When it comes to anterior restoration of teeth, patients are highly demanding and more possessive regarding the appearance of the restoration. Unaware in regards to the formalities of the procedure, they concentrate on the looks of the restoration and its replication to the adjacent teeth. Both shape and color of the restoration should twin with the adjacent tooth and color of the restoration being at the highest priority in judging successful and esthetically superior restoration.<sup>2</sup>

Frequently used method for shade selection in the dental office is visual shade matching and clinicians can master the skill of shade matching through clinical experiences, knowledge, and training of shade matching protocol.<sup>3</sup> Although many shade-matching instruments have been developed to increase the clinical success of color matching.<sup>4</sup> One among various recent advances for the ease of shade selection is Vita Easyshade compact. This device is handheld and gives electronic optical measurements. The supremacy and accuracy of the device in analyzing and reading shade are affirmed by the manufacturers. This technology rules out the human errors observed during visual matching as it is repeatable and accurate.

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The patient's opinion should be considered as a priority while shade matching.<sup>5</sup>

This study aims to analyze the accuracy and reliability of visual tooth shade selection by men and women in comparison with digital shade systems.

## MATERIALS AND METHODS

The study will be conducted on the patient to evaluate the reliability and accuracy of the visual method by two different observers (male and female) using a commercially available Vita classic shade guide against a digital shade matching device. Shade matching will be done using Vitapan classic shade guide on patient maxillary anterior by two different observers (male and female). Again, on the same

subject shade matching is done by using a digital shade matching device (Vita Easshade compact). The ideal site to evaluate the shade match is the middle third of the patient's tooth which is referred to as tooth's shade.

In the present study for data collection, we used Vitapan Classic Shade guide for shade selection, Rite lite for proper illumination, and Vita Easshade compact for digital shade evaluation.

Before selecting the shade, thorough oral prophylaxis is done for the patient, sterilization of the shade guide, and collaboration of instrument carried out before using Vita Easshade compact and the protective shield is inserted on the tips. Then, for each subject, the shade selection is done with Vitapan classic shade guide by the male and female observer and finally select the shade with Vita Easshade compact. After collecting the data, comparison and analysis of the data of Vita classic with Vita Easshade compact done.

Before initiating the shade matching, the participants were informed regarding the clinical procedure they are being subjected to, and written informed consent was obtained. Research has been conducted in full accordance with ethical principles, including permission from the institutional ethical committee.

Tooth color was measured in caries and fillings free maxillary anterior teeth. The total selected sample was 39. First measured tooth color with Vita classic shade guide by the male and female observer (Figs 1 and 2). Finally, tooth shade was measured with a digital method using Vita Easshade compact (Figs 3 and 4).

Collected data were exported into the CIE L\*a\*b\* system for the color measuring process. To measure color with Easshade, it was positioned and aligned correctly on the tooth (middle third of the buccal aspect of the tooth). All measurements were made by following the manufacturer's instructions. Before any measurement devices were calibrated.

The obtained data were tested for normal distribution by descriptive statistics test. Quantitative variables were compared using one-way ANOVA test. Multiple comparisons between groups were done by *post hoc* test (Bonferroni) test. Statistical analysis was done using the SPSS.

## RESULTS

Descriptive analysis for male and female observer for shade selected with Vita classic shade guide was presented in Table 1 (Fig. 5) and



Fig. 1: Shade selected by the male observer with Vita classic shade guide

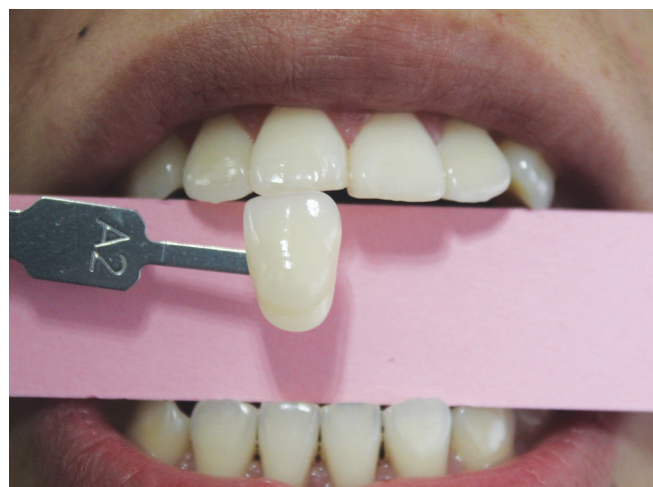


Fig. 2: Shade selected by the female observer with Vita classic shade guide

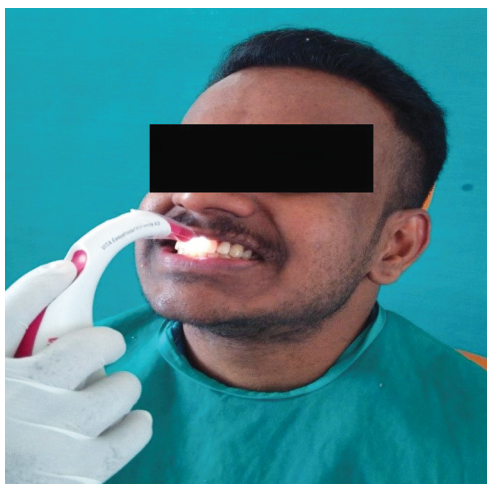
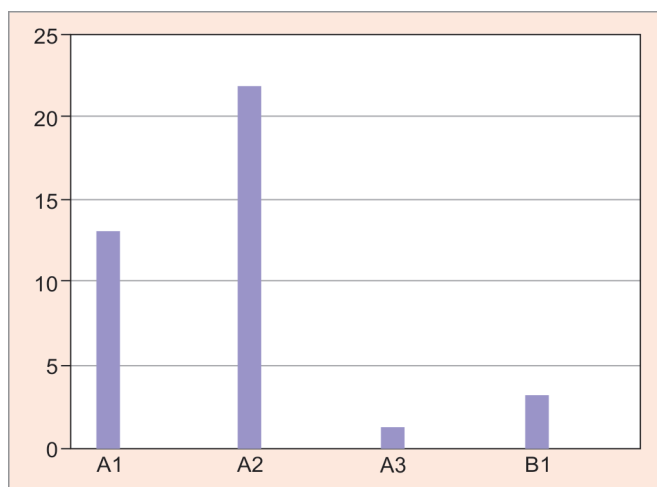


Fig. 3: Shade selection with Vita ES



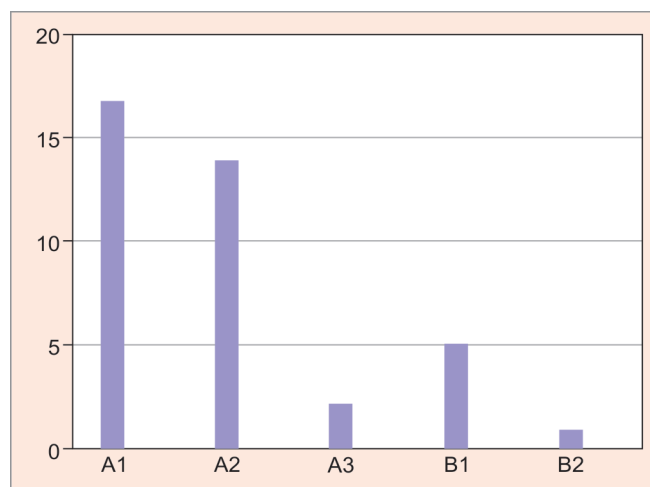
Fig. 4: Shade obtained with Vita ES



**Fig. 5:** Descriptive analysis for male observer for shade selected with Vita classic shade guide

**Table 1:** Descriptive analysis for male observer for shade selected with Vita classic shade guide

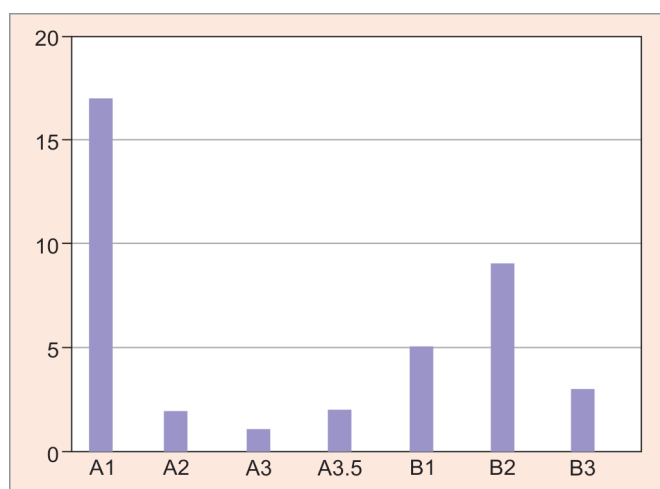
Male observer	Frequency	Percent
A1	13	33.33
A2	22	56.41
A3	1	2.56
B1	3	7.69
Total	39	100



**Fig. 6:** Descriptive analysis for female observer for shade selected with Vita classic shade guide

**Table 2:** Descriptive analysis for female observer for shade selected with Vita classic shade guide

Female observer	Frequency	Percent
A1	17	43.59
A2	14	35.90
A3	2	5.13
B1	5	12.82
B2	1	2.56
Total	39	100



**Fig. 7:** Descriptive analysis for shade selected with Vita easy shade compact

Table 2 (Fig. 6) respectively. Descriptive analysis for shade selected with Vita Easyshade was presented in Table 3 (Fig. 7).

The shade selected by the male observer by Vita classic shade guide was compared with Vita Easyshade compact (Table 4) and there was a significant difference in shade selected ( $p < 0.005$ ). The shade selected by the female observer by Vita classic shade guide was compared with Vita Easyshade compact (Table 5) and although there was a significant difference in shade selected, but difference was less ( $p < 0.001$ ).

**Table 3:** Descriptive analysis for shade selected with Vita Easyshade compact

Vita Easyshade compact	Frequency	Percent
A1	17	43.59
A2	2	5.13
A3	1	2.56
A3.5	2	5.13
B1	5	12.82
B2	9	23.08
B3	3	7.69
Total	39	100

Finally, when the shade selected by the male observer with the female observer was compared (Table 6) a significant difference between selected shades was obtained ( $p < 0.001$ ).

## DISCUSSION

The shade matching capabilities among women are assumed to be more evident when compared with men. Color deficiency among men is commonly seen but this fact has not affected the results of our study as all the observers enrolled were color normal. In a study done by Applebury and Hargrave, they found that in humans, two cone cell pigment genes are present on the X chromosome. If women are heterozygous, they could be tetra-chromatic, which adds an advantage in shade matching.<sup>6,7</sup> As there was no statistically significant difference in the quality of tooth color



**Table 5:** Comparison between Vita Easyshade compact and female observer

		Vita Easyshade compact							Chi-square	p value	
		A1	A2	A3	A3.5	B1	B2	B3	Total	value	
Female observer	A1	15	0	0	0	2	0	0	17	82.551	$p < 0.001$
	A2	2	2	1	0	0	6	3	14		
	A3	0	0	0	2	0	0	0	2		
	B1	0	0	0	0	3	2	0	5		
	B2	0	0	0	0	0	1	0	1		
Total		17	2	1	2	5	9	3	39		

**Table 6:** Comparison between male observer and female observer

		Female observer					Chi-square value	p value
		A1	A2	A3	B1	B2	Total	
Male observer	A1	9	0	0	4	0	13	44.652 $p < 0.001$
	A2	6	14	0	1	1	22	
	A3	0	0	1	0	0	1	
	B1	2	0	1	0	0	3	
Total		17	14	2	5	1	39	



study found that 8 categories, grouped by 16 shades, improved agreement among examiners and hence, lends credence to Sproull's observations.<sup>19</sup>

In the present study, the observer used Rite-Lite to maintain standard light protocol with a correlated color temperature of 5,500°K. Overall results show that there are significant ( $p < 0.005$ ) differences between shade selected by female and male observers compare to digital shade matching devices.

## CONCLUSION

The present study showed that female observers have better accuracy on visual shade selection under standard light illumination than a male observer in comparison with Vita Easyshade compact as shade selected by a female observer using Vita classic shade guide is closely matched with Vita Easyshade compact. But when the given shade guide and patient's teeth are to be matched, no cause exists, for the clinicians to be selected based on their gender. Better color vision screening should be performed for the clinician.

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