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Assessment of interoperator variability in shade selection using two shade guides: An observational study

Dr Ravinder Singh Saini

Associate Professor, COAMS, King Khalid University, Abha, Saudi Arabia
Corresponding author email: dr_ravi_saini@yahoo.com

Dr. Kanwalpreet Kaur

MDS, Pediatric and Preventive Dentistry, Consultant Pediatric Dentist, Ludhiana, Punjab

Abstract---Background: Shade determination for direct and indirect restorations has always been a challenging aspect of esthetic dentistry. Hence; the present study was conducted for assessing Interoperator Variability in Shade Selection using Two Shade Guides. Materials & methods: Two different shade guides used were: Shade Guide 1- Vitapan classical shade guide and Shade Guide 2-VITA toothguide 3D-Master shade guide. A total of 40 subjects were enrolled. Only those subjects were enrolled which had healthy maxillary right permanent central incisor. Two independent operators participated in the study. Each subject was seated upright in the dental chair and the middle third portion of the maxillary right central incisor teeth to be matched was slightly moistened. The percentage of variability in shade selection between the operators was calculated. All the results were subjected to statistical analysis. Results: For shade guide 1, kappa value and interpersonal variability was 0.89 and 16% respectively. For shade guide 2, kappa value and interpersonal variability was 0.71 and 29% respectively. Hence; interpersonal variability was higher for shade guide 2 in comparison to shade guide 1. Conclusion: From the above results, the authors concluded that VITA Toothguide 3D-Master showed higher variability in comparison with Vita lumen shade guide.

Keywords---variability, shade, guide.

Introduction

Shade determination for direct and indirect restorations has always been a challenging aspect of esthetic dentistry. Visual shade determination using commercially available shade guides, although the most frequently applied method, is considered highly subjective. It may be affected by variables such as external light conditions, experience, eye fatigue, and color blindness. In addition, standardized verbal means for the communication of visually assessed color characteristics are limited. Metamerism, light reflection, and individual characterization of natural teeth further contribute to variability in shade selection.¹⁻³

Previous authors have suggested other disadvantages with the use of shade guides. First, the range of available colors in the shade guides is inadequate and the color samples are not logically distributed. Second, there is a lack of consistency among and between dentists in using the shade guides to match colors. Third, it is not possible to translate the results obtained from shade guides into the "Commission Internationale de l'Enclairage" colour specifications.^{4, 5} Hence; the present study was conducted for assessing Interoperator Variability in Shade Selection using Two Shade Guides.

Materials & Methods

The present study was conducted for assessing Interoperator Variability in Shade Selection using Two Shade Guides. Two different shade guides used were: Shade Guide 1- Vitapan classical shade guide and Shade Guide 2-VITA toothguide 3D-Master shade guide. A total of 40 subjects were enrolled. Only those subjects were enrolled which had healthy maxillary right permanent central incisor. Two independent operators participated in the study. Each subject was seated upright in the dental chair and the middle third portion of the maxillary right central incisor teeth to be matched was slightly moistened. Then, all the three operators selected the shade under natural daylight source for all the 100 subjects. The selected shade by each operator was tabulated and assessed for interperson variability. The shade matching was considered as an agreement when the operators selected the same shade and as a disagreement when their shade matching was different. The percentage of variability in shade selection between the operators was calculated. All the results were subjected to statistical analysis.

Results

For shade guide 1, kappa value and interpersonal variability was 0.89 and 16% respectively. For shade guide 2, kappa value and interpersonal variability was 0.71 and 29% respectively. Hence; interpersonal variability was higher for shade guide 2 in comparison to shade guide 1.

Table 1: Agreement assessment between observers for Shade Guide 1

Variable	Kappa value	Interpersonal variability
Shade guide 1	0.89	16%

Table 2: Agreement assessment between observers for Shade Guide 2

Variable	Kappa value	Interpersonal variability
Shade guide 2	0.71	29%

Discussion

Esthetic excellence is largely an art with primarily subjective interpretation and not enough has been done to effectively analyze and formulate it. It is the subjectivity inherent in the shade matching process that people try to overcome. Yet, in dental shade matching, the human eye is still the most popular clinical approach. A person with color normal vision can recall approximately 300 different colors and is able to discriminate 5–10 million different colors in side-by-side comparisons. Even so, studies have reported that up to 80% of the patients express their dissatisfaction with perceptible shade differences. It has been affirmed that in dental shade matching, the eye is the finest null detector, nonetheless, observers must be trained to optimize their color perception. Shade matching is generally associated with homogeneously colored objects however, teeth vary in color and translucency. Consequently, they are thought to be more difficult to shade match.^{6- 10} Hence; the present study was conducted for assessing Interoperator Variability in Shade Selection using Two Shade Guides.

For shade guide 1, kappa value and interpersonal variability was 0.89 and 16% respectively. For shade guide 2, kappa value and interpersonal variability was 0.71 and 29% respectively. Hence; interpersonal variability was higher for shade guide 2 in comparison to shade guide 1. Hammad IA evaluated the effects of 2 shade guides on the intrarater repeatability (reliability) of prosthodontists and general practitioners with regard to shade selection. Ten prosthodontists and ten general practitioners (all men, 35-45 years old) with an average practice experience of 14 years participated in this study. Examiners were tested to eliminate color blindness. Each clinician used Vita Lumin Vacuum and Vitapan 3D-Master shade guides to determine the shades of the maxillary right canines of 20 patients following a standard protocol. Significant interactions were found between the effects of shade guide system and specialty training on intrarater repeatability ($P < .0001$, analysis of variance). The intrarater repeatability of prosthodontists was significantly higher than that of general practitioners when the Vita Lumin Vacuum shade guide was used ($P < .0001$, t test). Use of the Vitapan 3D-Master shade guide significantly improved the intrarater repeatability of general practitioners compared with the Vita Lumin Vacuum shade guide ($P < .0005$). This improvement was not significant, however, among prosthodontists ($P = .2861$). The prosthodontists demonstrated superior intrarater repeatability in shade selection, especially when the Vita Lumin Vacuum shade guide was used.¹⁰ Nakhaei M et al evaluated the influence of shade guide type and professional experience on shade-matching results. Thirty Dental students (DS), 30 General dentists (GDs) and 30 Dental specialists (S) participated in this study. The participants were asked to match six target tabs using two dental shade guides: Vitapan Classical (VC) and Vitapan 3D-Master (3D). An intraoral spectrophotometer was used for color measurement of target tabs and selected tabs. The color difference (ΔE) values between the target tab and selected tab were calculated. There were no significant differences among the three participating

groups in ΔE values when the 3D was used ($p = 0.389$). However, significant differences were found with VC ($p < 0.001$). The ΔE values achieved from the 3D were significantly lower than those from VC for DS and S ($p = 0.001$ and $p < 0.001$, respectively). For each of the first five best matches, the mean ΔE values from the 3D were smaller than the corresponding values of VC. The type of dental shade guide affected the shade-matching results. The level of experience was not found to be an influential factor in shade matching when 3D-Master shade guide was used.¹¹

Conclusion

From the above results, the authors concluded that VITA Toothguide 3D-Master showed higher variability in comparison with Vita lumen shade guide.

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