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Original Article

Identifying the tooth shade in group of patients using Vita Easyshade

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ABSTRACT

Objective: The aim of the present investigation is to identify tooth shade among a group of Sudanese patients. **Materials and Methods:** Total number of patients was 227. Participant's age ranged from 15 to 72 years, which, was divided into four groups. The tooth included in the study was either right or left sounds maxillary central incisor. Vita Easyshade was used to select the tooth shade. Investigation of the differences of Commission International de l'Eclairage (CIELab) coordinates among gender and state of origin was conducted together with an examination of the relationship between CIELab coordinates and age. One-way analysis of variance was used to test the differences in L*, a* and b* according to state of origin. **Results:** Results showed that A3 was the most common classical tooth shade respectively. There was highly significant difference in L* between males and females ($P = 0.002$). There was a significant relation between tooth shade and age ($P = 0.026$). There was a high significant association between classical tooth shade and Sudan regions ($P = 0.00$). **Conclusion:** In conclusion, most common classical shade was A3, women's teeth were lighter than men's. There was a relation between ethnic background and tooth shade.

Key words: Esthetics, Commission International de l'Eclairage, tooth shade, Vita Easyshade

INTRODUCTION

In contemporary dentistry, the needs of patients are considered in terms of function and dental appearance.[1] The ultimate objective of esthetics in dentistry is to create a beautiful smile[2] and the esthetics of any restoration needs to consider the parameters of surface form, translucency, and shade.[2] The shade of the restoration was found to be the most important factor in the patients' assessments.[3] About 80% and more of patients with an anterior metal ceramic restoration were aware of the shade mismatch relative to the adjacent natural tooth.[4] Accomplishing the shade selection is normally done by visually comparing the selected tooth to shade tabs from commercially available shade guides. There are two systems used to describe the color: The descriptive Munsell color system and the more quantitative Commission International de l'Eclairage (CIELab) system.[5] The Munsell system describes color in three attributes: Hue, chroma, and value. Used almost exclusively in color research, CIELab describes color as the product of blending three color coordinates; L*, a* and b*. By giving these three coordinates numerical values the CIELab system is able to locate an object in a three-dimensional (3D) color space. Tooth shade is measured by various methods, including visual assessment with a shade guide or instrumental measurement.[3] Due to inter-human differences in the perception of color, visual shade assessment of teeth is lacking standardization that may be improved by the use of a spectrophotometer.[6] The shades of several tooth-colored restoratives are now keyed to the Vita Classical Shade Guide, which is a very popular system in the dental industry.[7] To select a shade that will ultimately result in a restoration

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matching the adjacent natural dentition; it is helpful to have a background about the shade distribution within the specific group of people. More recently colorimeters, spectrophotometers, and image analysis techniques have been introduced and advocated to reduce the subjectivity integral in shade selection. Compared to conventional visual shade assessment, spectrophotometric analyses were determined to be more reproducible.[8-10] Many studies had implemented tooth color coordinates in association with age, gender and skin color[11-13] but little named the shades of teeth that can be found within the populations.[14]

Sudan is a large country with different racial backgrounds and different altitudes. Identifying tooth shade according to population distribution will limit the number of shade tabs that are needed for matching. A careful reduction of the number of shade tabs in the guide tested might simplify shade selection procedures and help to standardize shade-taking.[15]

MATERIALS AND METHODS

Total number of patients was 227 patients attending Conservative Dentistry clinic at the Faculty of Dentistry of the University of Khartoum, at the capital of Sudan. Participant's age, ranged from 15 to 72 years, which, was divided into four groups; Group 1 (10–20 years), group 2 (21–30 years), group 3 (31–40 years) and group 4 (41+ years). The tooth included in the study was either right or left sounds maxillary central incisor. Any tooth that was bleached or with enamel hypoplasia, fluorosis, veneered, carious or restored was excluded. Vita Easyshade was used to select the tooth shade. Investigation of the differences of CIELab coordinates among gender and state of origin was conducted together with an examination of the relationship between CIELab coordinates and age. One-way analysis of variance was used to test the differences in L*, a* and b* according to state of origin. A portable clinical spectrophotometer (Vita Easyshade, Vident, Brea, California, USA) was used to identify the tooth shade. The contact probe tip was held at 90° to the surface in the middle one third of the tooth. The display presents the closest Vita shade in the classical and 3D shade guide designation. According to the manufacturer, two identical readings are required to ensure the accuracy; the output reading was recorded. This reading in an extended mode display will show CIELab coordinates value. The data was analyzed by using the software SPSS statistical package version 11.5 (SPSS Inc., Chicago, IL, USA), One-way analysis of variance was used to test the differences in L*, a* and b*. All tests significance level was taken at the level of $P \leq 0.05$.

RESULTS

Seventy of the examined patients were males (30.84%) while 157 (69.16%) were females. Most of the participants fell in group 2 (21–30 years), which represents 44.9%, followed by group 1 (10–20 years) 23.3%, group 3 (31–40 years) 18.1% and group 4 (41+ years) 13.7%, respectively.

Shade A-type represented 78.5%, followed by shade C-(13.2%), D-(5.2%) and B-type (3.1%). The most common shades were A3 (36.1%), A2 (27.3%) and A1 (11.5%) respectively [Figure 1]. Results showed that there was a significant relation between tooth shade and age with P value at level 0.026. Shade A spreads widely among the groups. A3, A2 and A1 are the commonest shades in group 1 (10–20 years), 2 (21–30 years) and 4 (41+ years) while group 3 (31–40 years) has a sequence of A2, A1 andA3 [Table 1]. There was high significant association between classical tooth shade and regions ($P = 0.00$). Distribution of the study population was as follows: Northern (32%), Central (28%), Khartoum (13.80%), Kurdufan (13.30%), Darfur (5.80%), Eastern (5.30%) and Southern (1.80%). The most common shades in the Northern region and Eastern regions were A shade followed by the C shade; while in Central region there were A shade followed by the D shade. While in the western (which include Kurdufan and Darfur regions) also patients from the southern regions (in previous Sudan now known the South Sudan) the most common shade was B shade, followed by the A shade. The descriptive values of the color, CIELab coordinates (L*, a* and b*) are presented in Figure 2. There was high significant association between age and L*, a* and b*. Age is inversely related to L*,

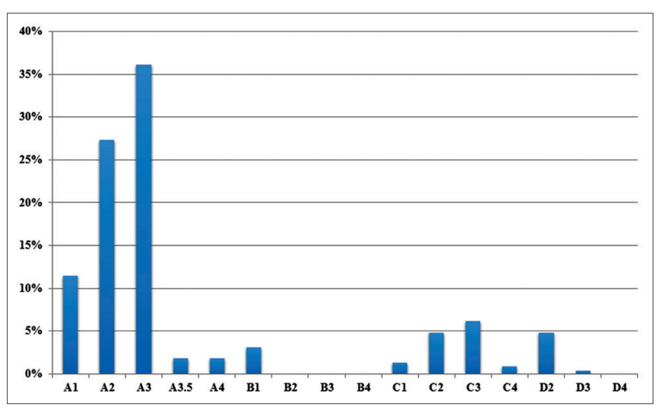

Figure 1: Classical tooth shade frequency

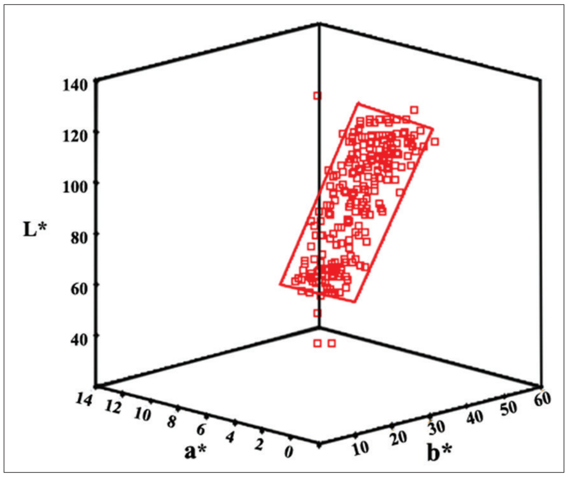

Figure 2: Distribution of tooth shade in Commission International de l'Eclairage color space

a* and b* (i.e. there was an increase shift toward dark, yellow and red).

The study revealed 22 shades for 3D master tooth shade. However, 10 of them represented in-betweens shade. The most common shades are 1 M 2 (29.1%), 0.5 M 2.5 (13.7%) and 0 M 3 (11.9%) [Figure 3].

DISCUSSION

The suggestion that population-specific classical tooth shade guide is attainable is supported by the results of this investigation; since there was a powerful relation between state of origin and tooth shade (P = 0.00). This scheme is supported by Cocking *et al*.[16] who proposed that optimized population-specific guides performed better, indicating the possibility for improvement in color compatibility of the guides in future shade guide development, allowing acceptable shade matching for most of the patients in clinical routine.[16] The distribution of natural tooth color, of this Sudanese sample, in CIElab color space presented by the plotted CIE L*, a* and b* [Table 2] values formed a parallelogram shape [Figure 2]. While the American and German have elongated oval and circular shapes, respectively.[16,17] These findings firstly revoked Vita assumption that the natural tooth color space, as a banana shape within the CIELab color space, represents each sector in the color space in which the natural tooth shade are found.[18] Second, present findings give rise to another proposition that compensating the differences of natural tooth color space may likely expand the options of shade selection for all populations. The significant relation between classical tooth shade and age (P = 0.026) was supported by worldwide studies.[12,14,16] Paravina *et al*.[19] divided tooth shades into 4 categories according to value:[19] The highest value group (shades A1, B1, A2, B2); high value group (shades C1, D2, A3, D4); medium value group (shades B3, B4, C2, D3); and low value group (shades A3.5, C3, A4, C4). In the present investigation, all examined groups ranged between the highest and high value groups this was in agreement with Jahangiri *et al*.[12] results

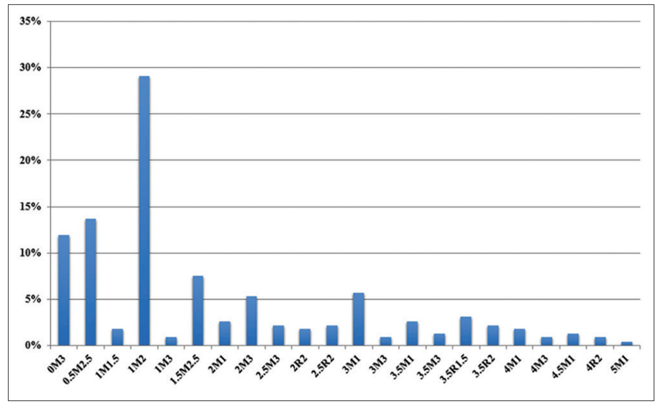

Figure 3: Three-dimensional master tooth shade frequency

Table 1: Association between classical tooth shade and age (P=0.026)

Classical tooth shade	Age by group (%)				Total (%)
	10-20	21-30	31-40	41+	
A1	2 (0.9)	12 (5.3)	8 (3.5)	4 (1.8)	26 (11.5)
A2	16 (7)	27 (11.9)	12 (5.3)	7 (3.1)	62 (27.3)
A3	30 (13.2)	37 (16.3)	7 (3.1)	8 (3.5)	82 (36.1)
A3.5	0 (0)	2 (0.9)	2 (0.9)	0 (0)	4 (1.8)
A4	1 (0.4)	1 (0.4)	0 (0)	2 (0.9)	4 (1.8)
B1	0 (0)	4 (1.8)	0 (0)	3 (1.3)	7 (3.1)
C1	1 (0.4)	1 (0.4)	0 (0)	1 (0.4)	3 (1.3)
C2	1 (0.4)	6 (2.6)	3 (1.3)	1 (0.4)	11 (4.8)
C3	1 (0.4)	5 (2.2)	4 (1.8)	4 (1.8)	14 (6.2)
C4	1 (0.4)	0 (0)	1 (0.4)	0 (0)	2 (0.9)
D2	0 (0)	6 (2.6)	4 (1.8)	1 (0.4)	11 (4.8)
D3	0 (0)	1 (0.4)	0 (0)	0 (0)	1 (0.4)
Total	53 (23.3)	102 (44.9)	41 (18.1)	31 (13.7)	227 (100)

Table 2: Correlation between age and L*, a* and b* at P<0.05

CIELAB	Age
L*	
Pearson correlation	−0.227
Significant (2-tailed)	P=0.001
a*	
Pearson correlation	−0.179
Significant (2-tailed)	P=0.007
b*	
Pearson correlation	−0.187
Significant (2-tailed)	P=0.005

CIELAB: Commission International de l'Eclairage in United States of America.[12] While the results of group 1 (10–20 years) and 2 (21–30 years) were similar to that obtained from Iraqi population,[14] there was difference in group 3 (31–40 years) and 4 (41+ years). This mismatch may be due to the sample size in both groups 3 and 4 where Hassan[14] had obtained a higher number of sample size. Jahangiri *et al*.[12] results concurred with Cocking *et al*.[16] in Germany and Ueda *et al*.[20] in Japan for the older age groups (46–60 and 61–80 years). Their results showed medium and low values tooth shade for these age groups respectively. This analysis of tooth shade/age relation revealed that same age group might have the same tooth shade worldwide. The above results explanation could be due to the significant relation between age and CIELAB coordinates (L* [$P = 0.001$], b* [$P = 0.005$] and a* [$P = 0.007$]) with increase of age teeth become darker, more yellow and more red. This finding was well documented in many studies.[11,14,21] Although Odioso and Reno,[21] and Gibb *et al*.[22] didn't include a* in their studies Xiao *et al*.[13] and Hasegawa *et al*.[11] found that the a* values showed no significant association. Moreover Zhao and Zhu[23] did not include b* in their study. While findings of Gozalo-Diaz *et al*.[24] comes into agreement with the findings of the present investigation.

The relationship between classical tooth shade and state of origin ($P = 0.00$) highlighted the effect of ethnic background on tooth shade. This finding was in concordance with international studies.[12,22]

The limitations of the present study may be derived from the sample size, selected populations as well as the measuring instrument. The sample does not represent a random sample of the Sudanese population so extrapolation of the present study results to the general population must be done with cautious. With regard to the population, (69.16%) of the recruited subjects were females, and most of the population were in group 2 (21–30 years) which represents 44.9%. The natural tooth shade females and younger individuals tend to be less saturated compared to males and older populations. This could be responsible for the concentration of measured shades in A-type. Vita Easyshade 5 mm probe captures roughly 25% of the color reflection of the measured tooth, while the middle area captured was most representative of a tooth's color, this limited window yields incomplete data.[25,26] The definition of shade according to regions could bring clinicians closer to reliable shade selection and predictable definitive color match. Further research is necessary to validate the present investigation findings. The participants should be balanced for age groups, ethnic background, and gender. Other contributing factors to the shade of teeth, such as genetics and influence of nutrition during the development of the tooth bud, should be investigated.

CONCLUSION

Within the limitations of this study, the most common classical shade was A3, women's teeth were lighter than men's. There was a relation between ethnic background and tooth shade.

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