

Factors Influencing Tooth Shade Selection for Completely Edentulous Patients

Temitope Ayodeji Esan, BCh.D, FMCDS;
Adeyemi Oluniyi Olusile, BDS, MSc;
Patricial Adetokunbo Akeredolu, BCh.D, FWACS, FMCDS



Abstract

Aim: There is limited scientific information on the relationship between tooth shade, age, gender, and skin color in black Africans. This lack of knowledge may impact the ability of the prosthodontist to select artificial teeth for completely edentulous patients. This study explores the possibility of a relationship between tooth shade, gender, age, and skin color in a black African population.

Methods and Materials: A total of 212 individuals aged 15 to 79 years participated in this study. One investigator, calibrated for examining tooth shade, performed all examinations. A Vita-Lumin shade guide was used to examine either the maxillary right or left central incisor. One had to be sound for inclusion in the study. Tooth shades were divided into two categories according to value, and skin tones were divided into two categories (light, and dark). Chi-square analysis and Fisher's exact tests were used to analyze the data ($P < 0.05$).

Results: No statistically significant difference was found between tooth shade and skin color and the subjects' perception of their tooth shade. However, a statistically significant difference was found between age and tooth shade ($P < 0.001$). There was also a statistically significant difference in tooth shade between men and women.

Conclusion: Within the limitations of this study, tooth shade value and skin color were not related. However, older adults and men are more likely to have darker teeth.

Keywords: Shade selection, gender, skin color, age, completely edentulous patients.

Citation: Esan TA, Olusile AO, Akeredolu PA. Factors Influencing Tooth Shade Selection for Completely Edentulous Patients. J Contemp Dent Pract 2006 November;(7)5:080-087.

Introduction

Selection of an appropriate tooth shade for edentulous patients is an important part of complete denture fabrication.¹ It has been shown proper shade selection has a positive impact on the patients' perception of esthetics and, ultimately, the acceptance of their dentures.¹

Although the dental literature is replete with anecdotal references about denture esthetics, it is an imprecise area combining both scientific and artistic principles.² These principles have been combined to give specific guidelines in teeth shade selection particularly among the multiracial communities. Little has been reported for a black African population.

Various studies have been conducted on the various determinants of color, i.e., value, hue, and chroma. Black's³ work published in 1908 was the first reference in the dental literature showing the importance of value in the shade determination process. He stated the best esthetic result was obtained when the proper color (hue) and translucence (value) were determined.³ He believed value was of greater importance than hue. This view was also supported by Clarke⁴ and Preston and Bergen.⁵

Various tooth shade guides have been developed through the last century⁶, but these have been essentially useful in patients with healthy natural teeth that could be used for comparison with the guide. However, in edentulous patients the use of a shade guide, photo colorimetric analysis, and digital shade analysis devices are limited. Hence, the prosthodontist has to look elsewhere for other guidelines for the selection of the proper shade of artificial teeth in completely edentulous patients. This is particularly true in a black African population where complete edentulism occurs at an early age due to widespread periodontal disease and the inadequacy of oral healthcare.⁷

Several factors such as age, sex, and skin color have been proposed as aids for artificial tooth selection, and numerous methods have been devised for the evaluation of reliable esthetic factors in determining artificial tooth selection for edentulous patients in predominantly white populations.⁸ To date, no universally reliable method of



determining tooth shade has been found and coupled with the fact there is limited scientific information on the relationship between tooth shade and these criteria in black African populations.

The color of the hair has been suggested by some dentists as a guide, but this is unreliable and can be inaccurate because hair color changes more rapidly than tooth color. Also, a person can change the color of their hair at will.⁹

The color of the eyes has also been proposed as a guide to the color of the teeth, but this is questionable since the iris is so small compared to the face and the eyes are not close to the teeth.⁹

Most authors favor the use of facial skin tones as a guide to tooth selection.⁹ Some have said people with fair complexions have teeth with less color range and color saturation thus, the teeth are lighter and in harmony with the colors of the face. Also, it has been said people with dark complexions generally have darker teeth that are in harmony with the color of the face.⁹

However, it was found tooth shade has an inverse relationship with skin color, i.e., the lighter the skin tone the darker the tooth shade.¹⁰ This study is similar to previous studies performed among multiracial populations in which dark-skinned people required a lighter tooth shade.¹¹

Primary teeth have been shown to have lighter value than permanent teeth. With respect to permanent teeth, tooth shade has been shown to have a direct relationship to age. As the age increases, there is an increase in dentin deposition which ultimately leads to darkening of the teeth.^{9,11,12} In a study conducted by Zhou JP et al.¹³ it was found teeth coloration fluctuates within

the period spanning the initial and final stages of puberty. This is characterized by a decrease in hue and value and an increase in chroma.

In addition, gender influence on tooth shade has been a subject of controversy. While some authors believe there is no significant relationship between gender and tooth shade, others believe there is a relationship between gender and tooth shade.^{9,11}

Current concepts on tooth shade selection consider the patient's perception of his or her tooth shade and color when selecting the appropriate tooth shade, especially in edentulous patients.^{2,14,15} No scientific support to this hypothesis exists at this time because many factors may influence the patients' choice of shade and color, especially in black African populations where white teeth are regarded as an element of beauty.

The aim of this study was to investigate the relationship between tooth shade and skin color, age, sex, and patients' perception of their tooth shade in a black African population.

Methods and Materials

A total of 212 individuals, 100 (47.16%) men and 112 (52.84%) women, aged 15 to 79 years (mean age being 32.11 ± 14.62 years) who had just undergone scaling and polishing participated in this study.

One investigator, calibrated for determining tooth shade, performed all examinations. A Vita Lumin (Vita Zahnfabrik H. Rauter GmbH & Co. KG, Bad Säckingen, Germany) shade guide was used to examine either the maxillary right or left central incisor one of which had to be free of any restoration, extrinsic stains, and caries-free for inclusion in the study.



Subjects with any tooth abnormality, intrinsic tooth stains, dermatological diseases, or those undergoing treatment for dermatological diseases on their facial skin were excluded from the study. Women with facial make-up such as lipstick were advised to remove it.

Tooth shades were divided into two categories according to value, A1, B1, A2, B2, C1, A3, A3–5, B3, C2, and C3. Skin tones were also divided into two categories (light and dark).

Data was analyzed using SPSS version 11. The analysis used included frequency cross tabulation, chi-square analysis, and the Fisher's exact test.

Results

The results of this investigation indicated there was a statistically significant difference between women and men with respect to tooth shade. More women (39.2%) had a lighter tooth shade than men and more males (20.7%) had a darker tooth shade than their female counterparts (13.7%) ($\chi^2 = 7.67$, $df=1$, $p=0.0056$) (Table 1).

The percentage of light tooth shades within the age groups decreases with age, and the percentage of dark shades within age group increases with age. This was found to be statistically significant (Fishers exact test, $P=0.000$) (Table 2).

One hundred and four subjects (49.1%) fall within the A2 category, while C3 was the least (1.9%). Generally, 139 (65.6 %) subjects belonged to the light shade category, while 73 (34.4 %) subjects fell within the dark shade category (Figure 1).

Eighty-one (38.2%) subjects perceived their tooth shade to be good, while the majority of the subjects, 115 (54.3%), perceived their tooth shade to be fair. Thirteen (6.1%) subjects perceived their tooth shade to be poor, while 3 (1.4%) were not sure (Figure 2).

One hundred eighteen (55.7%) subjects had a dark skin tone, while 94 (44.3%) subjects had a fair skin tone. One hundred and thirty nine (65.6%) of the subjects required light tooth shades and only 73 (34.4%) required dark tooth shades. Of the 94 subjects with fair skin, 63

Table 1. Distribution of tooth shade by gender.

Gender	Tooth Shade				Total	
	Light	%	Dark	%	No	%
Male	56	26.4	44	20.7	100	47.2
Female	83	39.2	29	13.7	112	57.8
Total	139	65.6	73	34.4	212	100

$\chi^2 = 7.67$, $df=1$, $p=0.0056$

Table 2. Distribution of tooth shade by age group.

Age group	Tooth Shade			
	Light		Dark	
	No	%	No	%
1-20	26	78.8	7	21.2
21-40	95	72.5	36	27.5
41-60	14	43.8	18	56.2
61-80	4	25.0	12	75.0
Total	139	65.6	73	34.4

Fishers exact test =0.000
 $\chi^2 = 22.989$, $df=3$, $p=0.000$

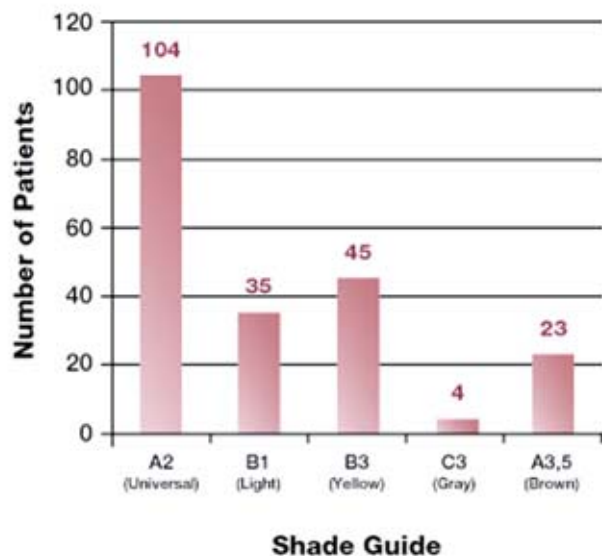


Figure 1. Distribution of tooth shades among subjects.

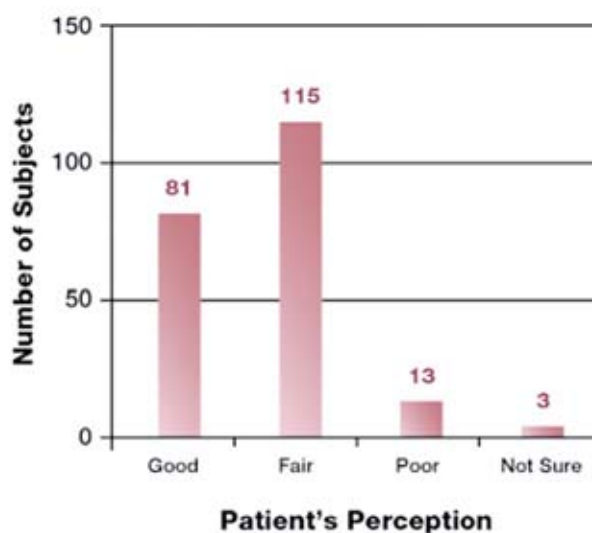


Figure 2. Patient's perception of their tooth shade.

Table 3. Distribution of skin color by tooth shade.

Skin color	Tooth shade				TOTAL	
	Light	%	Dark	%	No	%
Light	63	67.02	31	32.98	94	
Dark	76	64.41	42	35.59	118	
Total	139	65.6	73	34.4	212	100

$\chi^2 = 0.158$, df=1 p=0.691.

Table 4. Distribution of patient's perception by tooth shade.

Patient's Perception	Tooth Shade				Total	
	Light		Dark		No	%
	No	%	No	%		
Good	55	67.9	26	32.1	81	38.2
Fair	76	66.1	39	33.9	115	54.2
Poor	6	46.2	7	53.8	13	6.1
Not sure	2	66.7	1	33.3	3	1.4
Total	139	65.6	73	34.4	212	100

$\chi^2 = 2.379$, df=2, p=0.304

For the purpose of analysis row 4 was discarded

(67.02%) required a light tooth shade while only 31 (32.98) required a dark tooth shade. Also of the 118 dark skinned subjects, 76 (64.41) required a light tooth shade while 42(35.59) required a dark tooth shade. There was no significant relationship between tooth shade and skin color ($\chi^2 = 0.158$, p=0.691) (Table 3).

In terms of how patients rate the perception of their tooth color, 55 (67.9%) subjects out of 81 who rated their tooth shade to be good had light shade while 26 (32.1 %) had dark shade. In addition, 76 subjects (66.1%) out of 115 who rated their perception to be fair fell within the light tooth shade category while 39 subjects (32.9%) fell within the dark shade category. Six (46.2%) out of 13 who rated their tooth shade to be poor had a light shade, whereas the majority of them (53.8%) actually fell within the dark shade category (Table 4).

There was no statistically significant difference between subjects' perception of their tooth color and tooth shade ($\chi^2 =2.379$, df=2, p=0.304) (Table 4).

Discussion

Selection of teeth for edentulous patients when all records of form, color, and size have been lost requires knowledge and



understanding of a number of physical and biological factors directly related to the patient.⁹ The dentist is in the best position in the patient care process to accumulate, correlate, and evaluate biomechanical information to facilitate the selection of teeth to meet the individual esthetic and functional needs.⁹

Various pre-extraction visual aids like patient photographs, matching teeth of close relatives, or matching extracted teeth of the patient have been proposed in some prosthodontic texts but with little or no scientific support.^{2,9} These pre-extraction visual aids or guides may provide information regarding form and shape but not the shade of teeth.

It has been suggested the color of the face should be the basic guide to tooth color.⁹ Specifically, it is suggested the brilliance (value) of the teeth must correspond to darkness or lightness of the facial

skin tone while the hue must harmonize with facial color and the color saturation of the teeth color must also correspond with the saturation of facial color.^{9,11} However, this study indicated there was no significant relationship between facial skin color and tooth shade ($\chi^2=0.158$, $p=0.691$). The findings did not agree with the findings of Jahangiri et al.¹¹ and N'Guessan et al.¹⁰ who found significant inverse relationship between tooth shade value and skin color.

A perception among prosthodontists and restorative dentists has been individuals with darker skin color have lighter teeth shade. But this may not be the case since many extrinsic and intrinsic factors may affect both the skin color and teeth shade. A disagreement between the results of the present study and previous studies may be due to variations in sampling methods employed and also due to the fact there are no sharp contrasts between various skin tones in black African populations compared to the populations in previous studies. The majority of the population in this study (both light and dark skinned) required a light tooth shade value rather than a dark tooth shade value (Figure 1 and Table 3).

Historically, some have linked tooth shade to age.^{9,11,12,13} This study showed there is a significant relationship between patient's biological age and tooth shade with the tooth shade becoming darker as the age increases ($P<.001$). In the present study 73.3% of those aged 61 and above had teeth in the dark range values compared with 21.2% of those who are younger than 21. This is in close agreement with the results of Zhou et

al.¹³ who reported as the age increases there is an increase in dentin deposition which ultimately leads to darkening of the teeth.

Furthermore, the present study showed a significant relationship between gender and tooth shade ($\chi^2=7.67$, $df=1$, $p=0.0056$). This result is inconsistent with the findings of Jahangiri et al.⁹ who reported there was no significant relationship between tooth shade and gender.

Incorporation of the patients' perception of his/her teeth shade as a criterion in selecting teeth shade has also been suggested.^{2,14,15} No significant difference was found between patients' perception and tooth shade ($\chi^2=2.38$, $df=2$, $p=0.30$). It may be possible for the patient to mislead the prosthodontist while choosing a tooth shade. This is more likely in black African communities where light skin complexion and light tooth shade is considered an element of beauty. Hence, it is still the responsibility of the dentist to choose the teeth shade, however, patient satisfaction with the chosen tooth shade is essential.

Conclusions

Within the limitations of this study, the results indicated:

1. Tooth shade value and skin color were not related.
2. Older adults and men are more likely to have darker teeth.
3. A larger and multi center study may further be carried out to know the criteria for tooth shade value selection among the vast edentulous population in our communities.

References

1. Basker RM, Ogden AR, Ralph JP. Complete denture prescription- an audit performance. *BrDent J* 1993; 174: 278-284.
2. McCord JF, Grant AA. Registration: Stage III – selection of teeth. *British Dental Journal* 2000; 188: 660-666.
3. Black GV. *A work on operative dentistry*. Chicago; Medico-dental Pub Co; 1908: p 347.
4. Clerk EB. The color problem in dentistry. *Dent Digest* 1931; 37: 581.
5. Preston JD, Bergen SF. *Color science and dental art*. St Louis: Mosby; 1980: p6.
6. Marcucci B. A shade selection Technique. *J. Prosthet Dent*. 2003; 89:518-521.
7. Odusanya SA. Tooth loss among Nigerians: causes and pattern of mortality. *Int. J. Oral Maxillofac. Surg.* 1989; 16: 184-189.
8. Sellen PN, Jagger DC, Harrison A. Methods used to select artificial anterior teeth for the edentulous patient: a historical overview. *Int J Prosthodont.* 1999; 12(1): 51-8.

9. Zarb GA, Bolender CL, Hickey JC, Carlsson GE. Bouchers Prosthodontic treatment for edentulous patients. The C.V. Mosby Co. St Louis 1990. 338-340.
10. N'Guessan KS, N'Dindin AC, Koffi NJ, Assi KD, Odi AL. The complexion and color of teeth in a Black African population. (Apropos of a sample of 240 subjects] *Odontostomatol Trop.* 2001; 24(95): 25-8.
11. Jahangiri L, Reinhardt SB, Mehra RV, Matheson PB. Relationship between tooth shade value and skin color: an observational study. *J Prosthet Dent.* 2002; 87(2): 149-52.
12. Zhu H, Lei Y, Liao N. Color measurements of 1,944 anterior teeth of people in southwest of China-description *Zhonghua Kou Qiang Yi Xue Za Zhi.* 2001; 36(4): 285-8.
13. Zhou JP, Chen LP, Dong HB, Zhang FQ. The fluctuation of anterior teeth coloration during the period of growth puberty in children and adolescents *Shanghai Kou Qiang Yi Xue.* 2003; 12(5):338-340.
14. MacEntee MI. The complete denture: A clinical pathway. Quintessence Pub Co. Inc. Chicago . 1999: 27-29.
15. Brisman AS. Esthetics: a comparison of dentists and patients' concept. *J Am Dent Assoc* 1980; 100:45-52.

About the Authors

Temitope Ayodeji Esan, BCh.D, FMCDS



Dr. Esan is a Lecturer/Consultant in Removable Prosthodontics in the Department of Restorative Dentistry of the Faculty of Dentistry in the College of Health Sciences at Obafemi Awolowo University, Ile-Ife, Nigeria.

e-mail: ayo672002@yahoo.com

Adeyemi Oluniyi Olusile, BDS, MSc



Dr. Olusile is a Reader/Consultant in Fixed Prosthodontics in the Department of Restorative Dentistry of the Faculty of Dentistry in the College of Health Sciences at Obafemi Awolowo University, Ile-Ife, Nigeria.

Patricia Adetokunbo Akeredolu, BCh.D, FWACS, FMCDS



Dr. Akeredolu is a Lecturer/Consultant Removable Prosthodontics in the Department of Restorative Dentistry of the College of Medicine at the University of Lagos in Lagos, Nigeria.