

# Evaluation of the Color Distribution of Natural Teeth by Age in Saudi Sub-Population Using an Intraoral Spectrophotometer

Natural Teeth  
Colour  
Distribution By  
Different Age  
Groups

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## ABSTRACT

**Objective:** To evaluate the natural teeth shades distribution by different age groups and gender in a Saudi sub-population using a Spectrophotometer.

**Study Design:** Descriptive Cross-sectional Study

**Place and Duration of Study:** This study was conducted at the Qassim University dental clinics, Saudi Arabia from September 2020 to April 2021 for a period of 08 months.

**Materials and Methods:** Total of 180 participants with healthy Maxillary anterior teeth were recruited and were divided into 3 different age groups young (16-30), middle (31-49) and elderly (50-70). Color distribution of maxillary central incisors was evaluated using intra oral spectrophotometer. Data was collected and was analyzed using SPSS version 23. Chi square test and ANOVA two-way analysis of variance tests were applied to identify the influence of age and gender on each color variable, respectively.

**Results:** Chi-square test was used to compare gender with tooth shades and results showed that males have whiter teeth than females ( $P=0.016$ ). Comparison of age of individual to tooth shades was done and results showed that with age, the shade of teeth becomes darker ( $P=0.027$ ) and older individuals have darker teeth than younger ones.

**Conclusion:** The present study revealed that both the age and gender resulted in statistically significant difference with teeth shades. It was evident that males have whiter tooth shades than females and older people have darker tooth shades than younger individuals.

**Key Words:** Age, Color, Gender, Spectrophotometer, Tooth, Saudi Arabia

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## INTRODUCTION

The knowledge and understanding of the shade distribution of natural teeth among different age groups is of a significant importance not only to facilitate the color selection for the dentist, but also to avoid color mismatch<sup>1-3</sup>. Color is not something physical rather it is a sensation<sup>3</sup>.

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Tooth color determination can be attributed to complex physical and optical phenomena which take place when light interacts with dental tissues<sup>4-7</sup>. Combination of the light reflected from the enamel surface and the light scattered and reflected from both enamel and dentin results in the color of the natural tooth<sup>1,4,8-10</sup>. Dentin of tooth contains organic components which absorbs light in range of ultraviolet and visible spectrum. Light transmission through tooth can be affected by dentin thickness and enamel translucency<sup>2,8</sup>.

Color can be described in terms of three dimensions of hue, value and chroma according to Munsell<sup>1</sup>, Hue is the quality by which we distinguish one color from another. It is also called the basic color. Value is the relative lightening or darkness of a color and chroma is defined as the saturation of hue<sup>2,11-16</sup>. Keeping in view the previous studies, we came to know that hue of natural teeth lies in the range of yellow red to yellow<sup>1,10-14</sup>. Various factors affect tooth color among which age, gender and ethnicity are considered to be most important ones to affect the color distribution of central incisors. As the individuals age the color of teeth also change<sup>1-3,17-19</sup>. With aging, teeth become yellowish, reddish and darker due to formation of

secondary dentin, pigmentation in dentin, and enamel wear. Previous studies have reported that females have lighter and less saturated anterior teeth than men while in some studies no difference has been found between male and female tooth color<sup>1-3,13</sup>.

The most frequently used method of shade taking is subjective in which tooth color is matched using shade tabs from a color guide but now it can also be measured objectively using electronic devices like spectrophotometer<sup>1,2,4</sup>. Various dental shade matching devices are being used which are far more reliable than visual assessment. Choosing the right color can be easily achieved by using an intraoral device called spectrophotometer (VITA Easyshade), which is an optical instrument for measuring the intensity of light relative to wavelength<sup>4</sup>. Spectrophotometer measures the amount of visible spectrum light reflected from an object and converts it into various tooth shade values. Studies have shown that it is much more accurate than visual tooth color assessment<sup>4,5-7</sup>. Pecho et al. noted that spectrophotometers provide reliable assistance in shade matching when it is used in combination with visual color assessment<sup>1</sup>.

Main aim of esthetic dentistry is to create a refreshing pretty smile with ideal tooth color and arrangement in harmony with surrounding structures. Knowledge of tooth color distributions and the factors that influence these colors is greatly essential for esthetic restorations<sup>13,20-23</sup>. The aim of this study is to know and assess the color distribution in different ages in the Saudi population using intra oral spectrophotometer according to VITA Easy shade system in order to minimize the color mismatch between the restoration and the natural tooth and to facilitate the color selection for the dentist.

## MATERIALS AND METHODS

An ethical approval was obtained from institutional ethical review board at Qassim University (Ref no: EA/m-2019-3023) prior to initiation of data collection. A descriptive cross sectional study was performed to assess the color distribution of maxillary central incisors in Saudi population from September 2020 to April 2021. Informed consent was taken from the Saudi students studying at college of dentistry, Qassim University and individuals coming to visit dental clinics of Qassim University. Individuals with healthy maxillary anterior teeth with no oral and systemic diseases were included in the study while subjects with missing, badly decayed, restored and crowned anterior teeth were excluded from the study. Individuals with history of smoking or tooth bleaching and who disagreed to participate in the study were also excluded. Total (N) of 180 Saudi subjects were recruited for this study. The participants were recruited through convenience sampling technique. These individuals were divided into three age groups young (16-30),

middle age (31-49) and elderly (50-70). In each group color distribution of maxillary central incisors were evaluated as a representative of natural tooth color via spectrophotometer (VITA Easy shade)<sup>1,4,15</sup>. After testing the device for reliability and performance, the subjects were asked to brush their teeth for two minutes. In addition, the tip of device was covered with infection control shield to avoid cross infection. Finally, the color was measured placing probe tip perpendicular on the tooth surface.

Data was analyzed using SPSS version 25. Mean and comparison between each age group were calculated. Chi square test was used to compare the teeth shades of participants for statistical significance. ANOVA test was used to compare the shades of the three age groups.

## RESULTS

The current sample obtained was 180 (N) participants, 93 (51.6%) Saudi males and 87 (48.3%) Saudi females with healthy maxillary anterior teeth aged from 16-70 years. The percentage of young age group (16-30) was higher (38.3%) when compared with the middle age group (36.1%) and elderly group (25.6%) (Table-1). The frequency and percentages of different shade groups is shown in Table-2.

**Table No.1: Distribution of participants according to age groups**

Age Groups	Frequency (Percentage)
16-30	69 (38.3%)
31-49	65 (36.1%)
50-70	46 (25.6%)
<b>Total</b>	<b>180 (100%)</b>

**Table No.2: Distribution of different shade groups**

Shade Group	Frequency (Percentage)
<b>A1</b>	13 (7.2%)
<b>A2</b>	22 (12.2%)
<b>A3</b>	33 (18.3%)
<b>B1</b>	18 (10.0%)
<b>B2</b>	26 (14.4%)
<b>B3</b>	24 (13.3%)
<b>C1</b>	19 (10.6%)
<b>C2</b>	12 (6.7%)
<b>C3</b>	13 (7.2%)
<b>Total</b>	<b>180 (100%)</b>

The age group-wise comparison of frequency of different tooth shades revealed that in younger age group (N=69), B3 (11) shade was most common. Alternatively, in the middle age group (N=46), A3 (14) shade was found to be most. On the other hand, old age group (N=46) had A3 shade (14) as the common color (Table-3). The application of Anova test found statistically significant differences (P-value = 0.027) in teeth shades between age groups suggesting that with increasing age the shades become darker.

**Table No.3: Distribution of different tooth shades based on age groups**

		Tooth Shade									
		A1	A2	A3	B1	B2	B3	C1	C2	C3	Total
Age Group	16-30	5	9	5	8	8	11	9	5	9	69
	31-49	8	11	14	6	11	5	4	4	2	65
	50-70	0	2	14	4	7	8	6	3	2	46
Total		13	22	33	18	26	24	19	12	13	180

The gender-wise comparison of different shade groups exhibited significant difference between male and female individuals ( $p$ -value=0.016) with the male participants having lighter tooth shades as compared to females (Table-4).

**Table 4: Distribution of different tooth shades based on gender**

		Tooth Shade									
		A1	A2	A3	B1	B2	B3	C1	C2	C3	Total
Gender	Male	11	16	15	9	9	9	13	4	7	93
	Female	2	6	18	9	17	15	6	8	6	87
Total		13	22	33	18	26	24	19	12	13	180

## DISCUSSION

According to the results of this study, there were significant age and gender differences ( $p < 0.05$ ) in tooth shades of central incisors in Saudi population. The prime objective of esthetic dentistry is to create a beautiful pleasing smile with well aligned, adequately proportioned teeth in harmony with surrounding gingiva and facial symmetry<sup>2,9,13</sup>. Various factors including age, gender ethnic groups, skin color and gingival color influence the differences and changes in tooth color. Limited scientific knowledge exists regarding these factors<sup>1,17,18</sup>. This knowledge is significant for dentists regarding tooth shade selection for restorations and dental prosthesis<sup>17,20</sup>. In our study we have used spectrophotometer to determine tooth shades. Paul et al<sup>4</sup> and Bahannan et al<sup>5</sup> showed in their studies that spectrophotometer was far more superior in shade selection than visual methods.

Influence of gender on tooth shade has been previously studied and results have shown that in some studies there has been no difference between genders<sup>6-8</sup>. Alternatively, the researchers reported that females have whiter teeth than men<sup>2,9,10,11</sup>. Conversely, in current study male population has been found to have lighter tooth shades than women. A lot of factors can be responsible for this change like ethnicity, oral hygiene habits and dietary habits.

It has been reported that with age the central incisors get darker, yellowish and reddish in color. Eiffler and colleagues<sup>12</sup> found no significant difference in tooth color among two age groups of 50 years and 70 years. However significant color changes with aging were found in several previous studies<sup>13-15,19</sup>. Likewise, findings of the present study showed that in Saudi population teeth get darker in shade with aging. These changes in tooth color with aging may be associated with secondary dentine deposition, oral hygiene habits, use of certain medications, environmental factors and systemic diseases<sup>8,9</sup>.

Our study gives us vital information regarding tooth color changes with age and gender in Saudi population. Color is much more than something physical, it is a sensation<sup>3</sup>. Dentists play a vital role in providing esthetic smiles. Shade matching is a very crucial and sensitive step in providing esthetic restorations and dental prosthesis. Dentists can use this vital information of tooth color shade selection while choosing the most accurate shade before providing esthetic restorations and dental prosthesis<sup>14</sup>.

Our study has several limitations like the sample size was less and it can be increased to make the study more accurate and results more promising. In order to identify the most significant modulator of dental color change in aging, we need longitudinal researches to analyze the effect of environmental factors, dietary habits and personal habits on tooth shade as they can be responsible for changes in tooth color due to aging and gender difference<sup>1,3</sup>.

## CONCLUSION

In conclusion, the present study showed that both, the age and gender resulted in significant difference in teeth shades ( $p < 0.05$ ). As for the relation between the teeth shades and gender, it shows that the males have whiter shades when compared to females. As for the age groups, it shows that the older the age the darker the tooth shade.

### Author's Contribution:

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**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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