

# Relationship of Tooth Color with Skin and Eye Color Based on Gender in Young Indian Adults

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## ABSTRACT

**Aim:** To evaluate the relationship of tooth color with skin color and eye color based on gender in young Indian adults.

**Materials and methods:** Two hundred subjects (100 males and 100 females) in the age range of 20–35 years. Skin color was categorized using skin shade tab (aviance beauty palette); eye color was visually assessed; and  $L^*$ ,  $C^*$  and  $h^*$  values of tooth were measured using Vita EasyShade Intraoral Dental Spectrophotometer (Advance 4.0)<sup>™</sup>. Statistically significant differences between the groups were compared using one-way analysis of variance (ANOVA) and Tukey's test. Pearson correlation was used to see the linear relation between the variables.

**Results:** Significant correlation was observed between skin color and value, eye color and chroma, age, and value in males and females ( $p < 0.05$ ).

**Conclusion:** It was concluded that hue, value, and chroma of tooth are partially dependent on skin color, eye color, age, and gender. This study points out that no single parameter should be used while considering the selection of fixed anterior restoration in full-mouth rehabilitation cases as well as for a new set of complete dentures to an edentulous patient, instead various factors need to be kept in mind.

**Keywords:** Chroma, Eye color, Hue, Intraoral Spectrophotometer, Shade selection, Skin color, Value.

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## INTRODUCTION

Since the face acts like a frame into which the teeth fit, the shade of the teeth should therefore harmonize with the facial color.<sup>1</sup> Prosthetically speaking, dental beauty is generally considered to be natural or esthetically appropriate when tooth color is in harmony with its vicinity. When providing prosthesis to a dentate patient, the remaining natural dentition are frequently used to select the color of the artificial teeth, but this method cannot be used when providing a long-span anterior fixed partial denture or a new set of complete dentures to an edentulous patient. Since tooth color plays an important role in social attractiveness<sup>2</sup> and psychological effect, it is imperative that the dentist has the complexion type and age of the patient in mind, so that the operator tests the suggested colors<sup>3</sup> instead of searching aimlessly through the shade guide, as is generally the custom. Therefore, the most commonly associated features with facial attraction are eyes and skin tone.

Special devices such as spectrophotometer give result in a more objective measurement of color and have shown good repeatability of natural teeth color.<sup>4–6</sup> Spectrophotometers measure one wavelength at a time from the reflectance or transmittance of an object and have been used to measure the visible spectra of teeth.<sup>7</sup>

The purpose of this study was to relate tooth color with skin color and eye color of a subject and also to evaluate age wise and gender wise the differences that could be seen in relation to the tooth color in young Indian adults.

## MATERIALS AND METHODS

The study was conducted in the Department of Prosthodontics and Crown and Bridge and Implants, at Manav Rachna Dental College, Faridabad, Haryana, India. A total of 200 subjects (100 males and 100 females) from different geographical areas and in the age group of 20–35 years were assessed for tooth, skin, and eye color. The subjects were randomly selected, thus representing an excellent cross section

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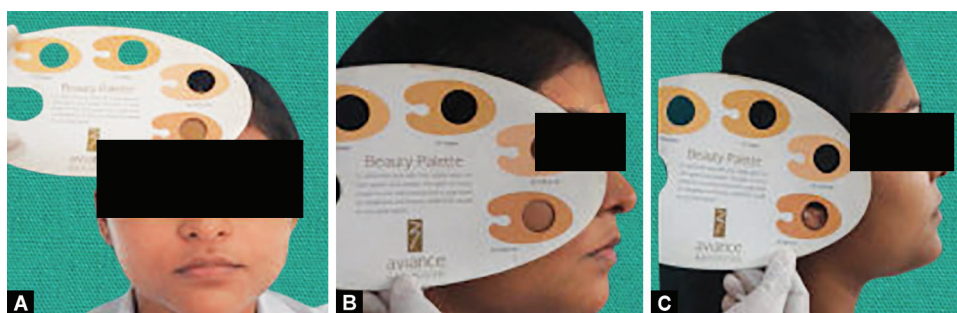
**Conflict of interest:** None

of Indian population. Subjects who were generally healthy individuals having all the maxillary and mandibular anterior teeth with satisfactory oral hygiene and healthy periodontium were included in the study and subjects with restored/ bleached anterior teeth, any tooth development abnormalities, intrinsic/extrinsic staining, eye contact lenses, bleached skin (<3 months) were excluded from the study.

The purpose and procedure of study was explained adequately and an informed consent was obtained from all the subjects. Each subject was made to sit upright on a dental chair, facing the natural daylight and viewed at eye level. Although spectrophotometer functioned independently of external light sources, assessing the skin and eye color required natural daylight.

Eye color or iris color was visually inspected and was assessed as:<sup>8</sup>

Score	Eye color
1	Blue, blue/green
2	Brown/gray
3	Dark brown
4	Black



Figs 1A to C: Subject's skin color being matched with skin shade guide on: (A) Forehead; (B) Malar area; (C) Earlobe



Figs 2A to C: Subject's tooth color being measured using VitaEasy Shade Advance 4.0 at: (A) Cervical third; (B) Middle third; (C) Incisal third

The facial skin was first gently cleaned with a wet cotton pad to remove any dust or makeup. Skin color was determined on three different sites of facial skin<sup>9</sup> (Fig. 1), i.e., the forehead at 3 cm above the nasal bridge, the malar area at the intersection of the ala-tragus line, with a vertical line from outer canthus, and the earlobe in the middle of its outer surface, and then it was categorized using skin shade tab (aviance beauty palette) as:

Score	Skin shade
1	Very light
2	Light
3	Middle
4	Dark

Tooth color measurements were made after cheek retractor was placed to obtain full exposure of the maxillary central incisors. The instrument was calibrated with the integrated calibration block and then measurement of tooth area's icon was selected.

It was made sure that central incisor is wider than the probe tip and then the tip was placed 2 mm away from the gingival edge to get the color of cervical area (Fig. 2A). After the indication of two rapid beeps, the probe tip was placed on the middle area (Fig. 2B) and then on the incisal area (Fig. 2C).

To receive extended color information, middle area was selected and expressed on three axes describing the color in three-dimensional color space:

$L^*$  (value; lightness of color, values from 0 = black to 100 = perfect white)

$C^*$  (chroma; saturation of color, 0 = 0% saturation to 100 = 100% saturation)

$h^*$  (hue; corresponding to wavelength, commonly called color)

The data obtained were arranged systematically and was transferred to Statistics Package for Social Sciences software version 16.0 for analysis.

## RESULTS

Relationship of skin color, eye color, age, and gender with mean values of  $L$ ,  $C$ , and  $h$  with their standard deviations are summarized

in Table 1. Continuous variables were presented as mean  $\pm$  standard deviation. Statistically significant differences between the groups were compared using one-way analysis of variance (ANOVA), and Tukey's honest significant difference *post hoc* test was applied to confirm where the differences occurred between groups. Unpaired  $t$  test was applied to test the difference between mean values in two groups, i.e., male vs female. Pearson correlation was used to see the linear relation between the variables. At 95% confidence level,  $p < 0.05$  was considered significant.

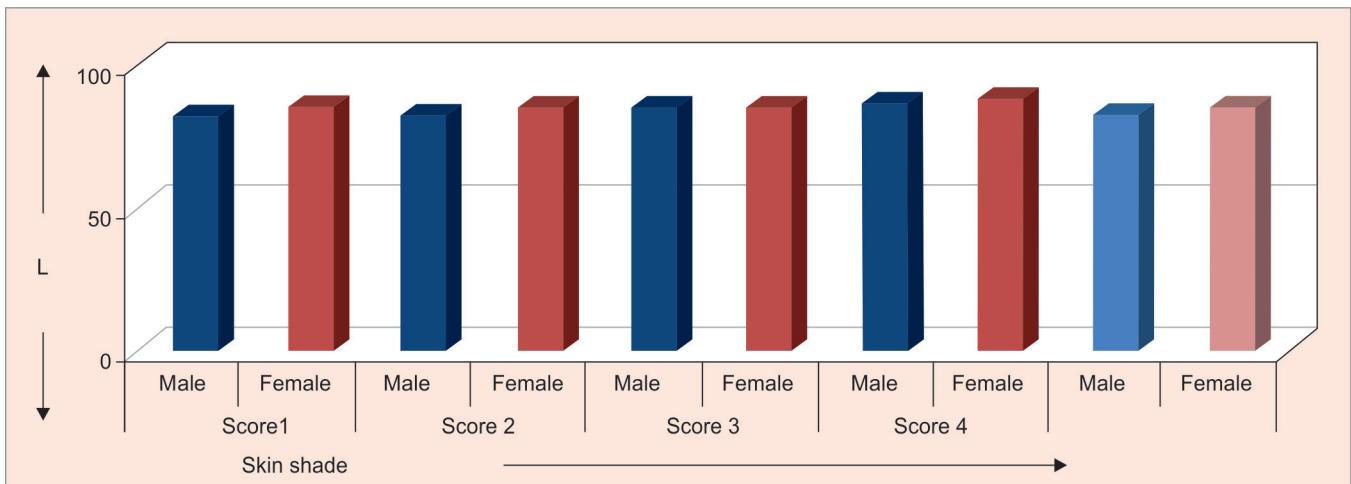
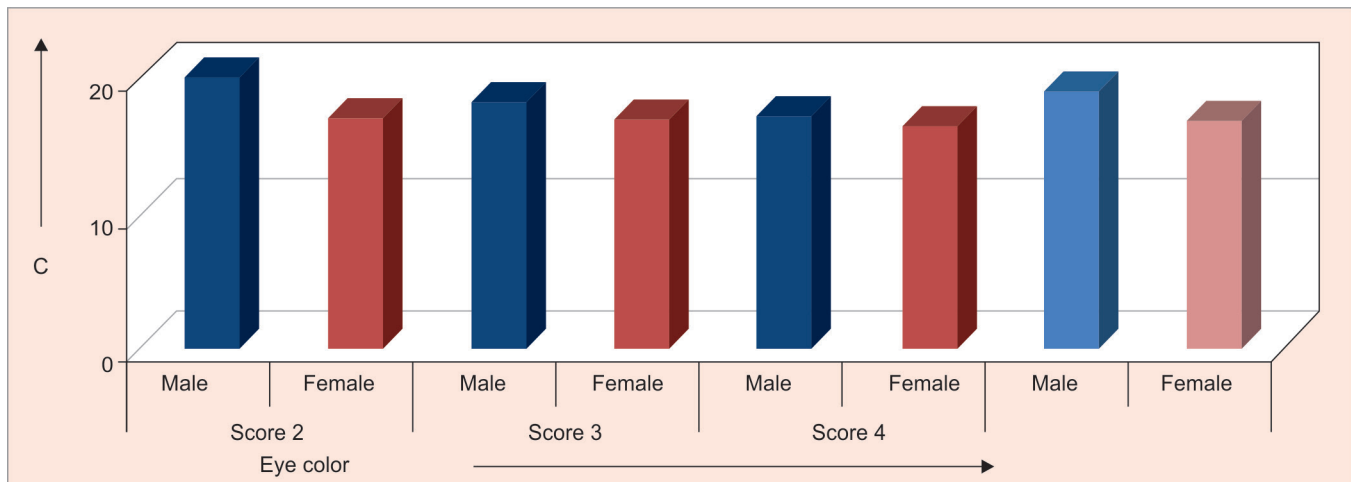
The results showed negative and significant correlation between skin color and value ( $L^*$ ) (Fig. 3). Chroma and hue showed insignificant correlation with skin color. Negative and significant correlation was seen between eye color and chroma of tooth (Fig. 4) but  $L^*$  and  $h^*$  showed insignificant correlation with eye color. A negative but significant correlation was presented between age and value (Fig. 5), whereas  $C^*$  and  $h^*$  showed insignificant correlation with age. Males showed lower  $L^*$  value, higher  $C^*$  value, and lower  $h^*$  value compared to females.

## DISCUSSION

The study reported a negative and significant correlation between skin color and value ( $L^*$ ). This is in accordance with various studies published earlier which concluded that tooth shade is significantly associated with color of the skin, where lighter skin tones have teeth with darker colors (lower  $L^*$ ) while those with darker skin tones possess teeth of lighter colors (higher  $L^*$ ). The results of present study also confirmed nonsignificant correlation between skin color and chroma ( $C^*$ ) and hue ( $h^*$ ) of tooth. The results are in agreement with that of Jahangiri et al.,<sup>10</sup> Azad et al.,<sup>11</sup> Sharma et al.,<sup>12</sup> and Haralur et al.,<sup>13</sup> who found a negative relationship of skin to teeth color. The methodology in these studies were different as the skin color was evaluated on subject's hand in the study conducted by Jahangiri et al.<sup>10</sup> Al-Dwairi et al.<sup>14</sup> concluded in their clinical that there was only moderate agreement between skin and teeth color. Whereas Lagouvardos et al.<sup>9</sup> found positive but weak correlation between tooth color and skin color. The results are in contrast with those of Hassel et al.,<sup>8</sup> Dummett et al.,<sup>15</sup> Gozalo-Diaz et al.,<sup>16</sup> and Esan et al.<sup>17</sup>

**Table 1:** Relationship of skin color, eye color, age, and gender with mean  $L^*$ ,  $C^*$ , and  $h^*$  values with their standard deviations (SDs) ( $n$  = number of subjects)

	$L^*$		$C^*$		$h^*$	
	Mean	SD	Mean	SD	Mean	SD
<b>Skin color score</b>						
1 ( $n = 16$ )	83.16	4.90	17.99	3.60	94.25	3.17
2 ( $n = 59$ )	84.16	4.24	19.04	4.48	93.36	3.07
3 ( $n = 102$ )	85.33	4.74	16.25	3.31	94.36	2.74
4 ( $n = 23$ )	86.78	3.90	14.78	2.56	96.16	2.65
<b>Eye color score</b>						
1 ( $n = 0$ )						
2 ( $n = 62$ )	83.53	4.85	19.41	5.34	94.02	3.69
3 ( $n = 110$ )	84.13	4.81	17.54	3.57	93.91	2.95
4 ( $n = 28$ )	84.49	4.08	16.80	2.51	94.49	2.54
<b>Age range</b>						
20–23 ( $n = 71$ )	89.04	0.97	17.22	3.14	94.33	2.74
24–27 ( $n = 51$ )	84.86	1.22	17.58	3.63	94.80	3.43
28–31 ( $n = 35$ )	80.99	1.01	18.18	4.84	93.99	2.67
32–35 ( $n = 43$ )	77.09	1.05	19.73	5.26	92.64	3.38
<b>Gender</b>						
Males ( $n = 100$ )	82.68	4.54	19.10	4.66	93.57	3.24
Females ( $n = 100$ )	85.31	4.54	16.94	3.34	94.48	2.97

**Fig. 3:** Negative and significant correlation between skin color and  $L^*$  in males and females**Fig. 4:** Negative and significant correlation between eye color and  $C^*$  in males and females

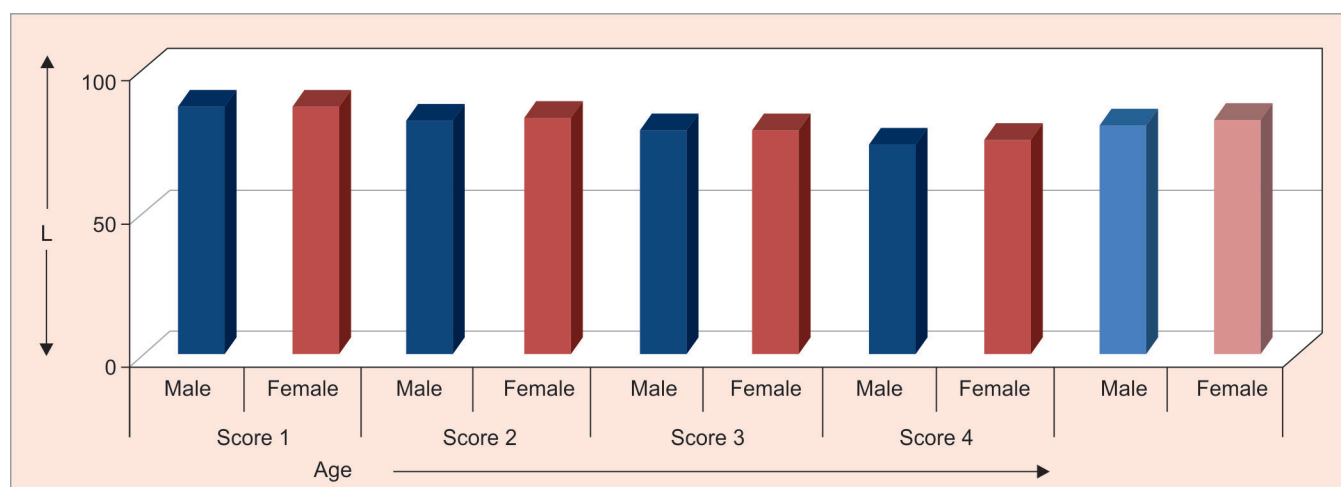


Fig. 5: Negative but significant correlation between age and  $L^*$  in males and females

who found no relationship of skin to teeth color. However, these differences may be due to population variability.

The second objective of the study was to determine whether correlation existed between tooth color and eye color. Although insignificant relation was observed between eye color and  $L^*$  and  $h^*$  of teeth, but a negative and significant relation was seen between eye color and chroma of tooth. Although not many studies have been conducted to determine the relationship between tooth and eye color, but Lagouvardos et al.<sup>9</sup> in their clinical study stated that no linear relation exists between eye and teeth color. This is partially in accordance with the conclusion of Hassel et al.,<sup>8</sup> who found in a multivariate analysis, that higher  $L^*$  values of teeth were associated with subjects having lighter eye color. The clinical significance points out that teeth color should not be based on patient's eye color alone. Skin color also has a correlation with eye color but only in populations with dark skin tones,<sup>18</sup> who tend to have darker eye colors.

The third objective of this study was to determine age-wise and gender wise relationship with tooth color. Significant difference was observed between males and females in case of  $L^*$ ,  $C^*$ , and  $h^*$ . Males showed darker teeth compared to females. In present study, males showed darker teeth compared to females. This is in accordance with Hassel et al.,<sup>8</sup> where males have lower  $L^*$  value, higher (more intense)  $C^*$  value, and lower  $h^*$  value as compared to females. In an earlier study conducted by Odioso et al.,<sup>19</sup> it was shown that compared to men, women had statistically lighter and less yellow teeth when tested. According to Jahangiri et al.,<sup>10</sup> no significant difference was observed in tooth color between males and females involving natural teeth.

In the present study, it was found that a negative but significant correlation was observed between age and  $L^*$  in males and females. A nonsignificant correlation was seen between age and  $C^*$  and age and  $h^*$  in males and females. This is in accordance with the studies conducted by Jahangiri et al.,<sup>10</sup> Azad et al.,<sup>11</sup> Esan et al.,<sup>17</sup> and Veeraganta et al.,<sup>20</sup> where it was concluded that older adults are more likely to have darker teeth.

## CONCLUSION

Within the limitations of the present study, it can be concluded that tooth color is partially dependent on facial characteristics including skin and eye color as well as other characteristics such as age and

gender and that no single parameter can be used while considering the selection of fixed anterior teeth restoration as well as for a new set of complete dentures for an edentulous patient. Instead, the opinions and desires of clinician based on clinical judgment should be taken into account to ensure optimal dental esthetics for each individual.

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