<div align="right">Review Article</div>

Association between Tooth Shade and Skin Colour A Descriptive Cross Sectional Study

Dr. Abhimod R[1], Dr. Ananda S.R MDS[2]*, Dr. Jithesh Jain[3], Dr. Aswathi Ashok MDS[4]

[1]Post Graduate Student, Department of Public Health Dentistry, Coorg Institute of Dental Sciences, Virajpet, 571218. Karnataka
[2]Professor, Department of Public Health Dentistry, Coorg Institute of Dental Sciences, Virajpet, 571218, Karnataka, India
[3]Professor and Head, Department of Public Health Dentistry, Coorg Institute of Dental Sciences, Virajpet, Karnataka-571218, India
[4]Senior Lecture, Department of Public Health Dentistry, Sree Anjaneya Institute of Dental Sciences, Calicut, India

Abstract

Teeth are very important for the appearance of an individual. The colour of the teeth is also equally important as it as a harmony with surrounding environment such as skin, hair, eye colour. The purpose of this study was to assess the association between tooth shade and skin colour among dental college students. The present cross sectional study was carried on 140 undergraduate and post graduate Dental students. After recruiting study subjects based on study criterias, The shades of middle third of labial surface of permanent maxillary left or right central incisor were taken by using the Vita pan classic shade guide. Next, skin color/tone was matched by using the Ideal Balance Quick Stick makeup shades as a guide. Results were analyzed using chi square test and spearman's correlation. There was a negative correlation between age and skin colour which was statistically significant (p = 0.023). Conversely, there was a positive correlation between age and tooth colour which was statistically significant (p = 0.017). There was a negative correlation between gender and skin colour (p=0.430). Similarly a negative correlation was observed between gender and tooth colour which was statistically non significant (p= 0.846). There was a negative correlation between skin colour and tooth colour which was statistically significant (p < 0.000). The results of this observational study suggest that there is a significant relationship between tooth shade and skin color. Based on the relationships skin color may be a useful guide for the selection of tooth shade.
Keywords: Skin colour, tooth colour, tooth shade, shade guide, skin tone and vita pan.

INTRODUCTION

In dentistry smile is one of the most evident and visible record of a patient. The role of tooth shade in esthetics cannot be underestimated as it plays a vital role in molding one's perception of smile attractiveness in today's beauty consciqous society [1]. Ever since dentistry has evolved, dentists have been facing the challenge of harmonizing tooth shade with facial appearance in fully edentulous patients. Prosthodontists suggests that there should be a sort of harmony between tooth shade and surrounding environment such as skin, hair, eye colour and age which overall will provide a synergistic effect on improving facial aesthetics [2].

Studies done by Boucher *et al.*, and Winkler clearly mention that the hue of teeth should harmonize with the patient's complexion. They also advocated using the facial skin colour as one basic guide in selecting colour for artificial teeth in Caucasians. The knowledge of human tooth colour and its distribution is very important to the understanding of matching in aesthetic dentistry [3].

There exists a general misconception among public that individuals with white teeth are more attractive and socially acceptable compared to persons with yellow teeth. But as dentists we are aware of the fact that there are several factors guiding teeth colour, the important ones being age, skin colour and gender. Teeth colour has a strong correlation with age. As age advances, due to the deposition of secondary dentine, pulp chamber becomes narrower and gives an opaque and yellowish appearance [4].

In aesthetic dentistry colour of facial skin is of paramount importance as it serves as a reference for tooth shade selection. Facial skin colour is considered as a frame into which the picture (teeth) will fit. So without a doubt the shade of the teeth should harmonize with the color of the skin of the face [3].

Various disparities exist in the studies and surveys conducted in investigating the relationship of skin color to tooth shade. Some of the studies found inverse relationship between skin color and tooth shade while some studies showed no significant association between skin colour and tooth colour [5]. This variation in results can be attributed to the differences in the ethnicity of the populations being studied. Our understanding of dental shades is entirely based upon studies carried out in western countries.

Furthermore, no local literature or research work is available on our population in this regard. Identifying tooth shade according to our population age 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 Therefore, the purpose of this study was to assess the association between tooth shade and skin colour among dental students in Coorg institute of dental sciences, Virajpet.

Objectives of the study were to record the shade of middle-third of labial surface of permanent maxillary central incisor by using the Vitapan classic Shade Guide and to investigate the possibility of a relationship between shades of teeth and skin color and to correlate shades of teeth to skin color according to age and gender.

Experimentation Section

The present cross sectional study was carried Coorg Institute of Dental Sciences, among undergraduate and post graduate Dental students.

Ethical clearance was obtained from institutional ethical committee. The study was conducted over a period of one week.

Sampling Technique

Sample size was determined using the formula n = N/1+Ne2 Accordingly a total of 140 undergraduate and post graduate students studying in Coorg Institute of Dental Sciences Virajpet were included in this study with following study criteria's.

Inclusion Criteria
- Dental students in Coorg institute of dental sciences including post graduate students.
- Subjects above 19 years with fully erupted, non carious, un restored maxillary central incisors without any developmental defects and disease.

Exclusion Criteria
- Subjects who have a history of bleaching procedures, fracture lines intrinsic, extrinsic or tetracycline staining, xerostomia, radiation therapy, smoking or abnormalities in tooth development will be excluded.

- Female subjects who wear any makeup, lipstick or lip gloss.
- Tooth with direct restorations, veneer, and crown.
- Subjects who are not willing to participate in the study.

Informed Consent

Written informed consent (English) was obtained from all the participants.

Method of Collection of Data

The shades of middle third of labial surface of permanent maxillary left or right central incisor were taken by using the Vita pan classic shade guide. Cheek retractor was placed and any child wearing eyeglass was asked to remove them to avoid any color distraction.

The color shade was assessed by visual observation using natural light. The viewer was positioned away from the patient, so the tooth to examine was approximately at the examiners eye level. The shade tab was held parallel to the incisal edge of the tooth because this effectively isolates the shade tabs from the teeth, so they do not reflect onto each other, producing after images. The distance between the eye and the tooth to be examined was standardized with a reading distance of 25–33 cm.

The shade tab was positioned close to the tooth and did not cover the adjacent tissues. To prevent the onset of eye fatigue, the time for the examination was 5 s after which the viewer rested his eyesight on a blue card before examining the adjacent teeth so as to prevent any bias. Subjects were draped with a gray-blue napkin, which also served to cover any bright clothes. Female patients were asked to remove any lipstick.

Subjects were asked to rinse the mouth with normal tap water prior to shade evaluation. Shade tabs were moistened before placing them in the correct position on the inside of the upper lip next to the tooth being matched. Tooth shade values were recorded in the pro forma.

Next, skin color/tone was matched by using the Ideal Balance Quick Stick makeup shades as a guide. Skin tones were divided into 3 categories: light, medium and dark. Various shades of the makeup were arranged into corresponding skin tone groups devised. This distribution was as follows: "light" skin tone group includes the soft ivory, pale, nude beige and natural beige shades of the makeup; "medium" skin tone group includes the sand, buff, golden beige and sun beige shades of the makeup; and "dark" skin tone group includes the caramel beige, crème café, cappuccino and cocoa shades of the makeup.

Skin tone determinations were acquired from back of the hands as the area was free of makeup or residues.

Statistical Analysis

Descriptive statistics were computed. Categorical data was presented as numbers and percentages. Results were analyzed using chi square test and spearman's correlation at 95% confidence interval using SPSS software version 17.

RESULTS

Table-1: Distribution of the study subjects according to tooth colour

		Gender		Total
		Male	Female	
Tooth colour	B1	5 7.1%	7 10.0%	12 8.6%
	A1	15 21.4%	12 17.1%	27 19.3%
	B2	11 15.7%	9 12.9%	20 14.3%
	D2	6 8.6%	10 14.3%	16 11.4%
	A2	8 11.4%	10 14.3%	18 12.9%
	C1	4 5.7%	4 5.7%	8 5.7%
	C2	5 7.1%	3 4.3%	8 5.7%
	D4	3 4.3%	3 4.3%	6 4.3%
	A3	3 4.3%	4 5.7%	7 5.0%
	D3	3 4.3%	1 1.4%	4 2.9%
	B3	1 1.4%	2 2.9%	3 2.1%
	A3.5	2 2.9%	5 7.1%	7 5.0%
	B4	4 5.7%	0 .0%	4 2.9%
Total		70 100.0%	70 100.0%	140 100.0%

$\chi^2 = 9.351$, p = 0.673 Non Significant

Table-1 shows distribution of study subjects according to tooth colour. The most prevalent tooth shade among the study subjects was A1 (19.3%) of which 15 subjects were males and 12 were females. Least prevalent tooth shade among males was found to be B3 (1.4%) and among females it was found to be B4 (0%). The distribution of study subjects according to tooth colour was however non significant (p = 0.673) with a chi square value of 9.351.

Table-2: Distribution of the study subjects according to skin tone

		Gender		Total
		Male	Female	
Skin colour	Light	20 28.6%	16 22.9%	36 25.7%
	Medium	16 22.9%	30 42.9%	46 32.9%
	Dark	34 48.6%	24 34.3%	58 41.4%
Total		70 100.0%	70 100.0%	140 100.0%

$\chi^2 = 6.429$, p = 0.040 Significant

Table-2 shows distribution of the study subjects according to skin tone. Majority of the study subjects (41.4%) were having dark skin tone of which 24 were females and 34 were males. Among the study subjects, majority of males were having dark skin tone accounting for 48.6% and females were having a medium skin tone accounting for 42.9%. The distribution of study subjects according to skin tone was found to be statistically significant (p = 0.040) with a chi square value of 6.429.

Table-3: Correlation between Age, Skin colour and Tooth colour

	skin colour	Tooth colour
Age	-0.192*	0.201*
	.023	0.017
	140	140

Table-3 shows correlation between Age, Skin colour and Tooth colour. Accordingly there was a negative correlation between age and skin colour among the study subjects which was found to be statistically significant (p = 0.023). Conversely, there was a positive correlation between age and tooth colour which was also found to statistically significant (p = 0.017).

Table-4: Correlation between Gender, Skin colour and Tooth colour

	Skin colour	Tooth colour
Gender	-0.067	-0.017
	0.430	0.846
	140	140

Table-4 shows Correlation between Gender, Skin colour and Tooth colour. Accordingly there was a negative correlation between gender and skin colour which was statistically significant (p=0.430). Similarly a negative correlation was observed between gender and tooth colour among the study subjects which was also statistically significant (p= 0.846).

Table-5: Correlation between Skin colour and Tooth colour

	Tooth colour
Skin colour	-0.830**
	0.000
	140

Table-5 shows Correlation between Skin colour and Tooth colour. Accordingly there was a negative correlation between skin colour and tooth colour among the study subjects which was found to be statistically significant (p < 0.001).

DISCUSSION

The present study tried to establish a relationship between tooth shade and skin color among graduate and post graduate students pursuing degree in the dentistry discipline in Coorg Institute of Dental Sciences, Virajpet according to their age and gender. The importance of esthetics in dentistry is of paramount importance and has shown marked increase owing to new interest and public awareness [1]. Though, visual shade analysis is being regarded as unreliable, it remains the most commonly used method in clinical dentistry because it is both quick and cost-effective.[6] The three components of color in this system were hue, value, and chroma. Hue was defined as the particular variety of a color, shade, or tint produced by a specific wavelength of light acting on the retina. Chroma was defined as the intensity of a hue that is amount of color saturating per unit area of an object. The value was defined as the relative lightness or darkness of a color or the brightness of an object. Value is considered to be of greater importance [1].

In the present study, for tooth shade determination, we used the middle site of the tooth because there is a color gradation in natural teeth from the incisal to the cervical areas. The middle site of the teeth is said to be best representative of its color because the incisal site is most often translucent and is affected by its background while the cervical color is modified by scattered light from the gingiva [3]. Although the color of the facial skin serves as basic guide in shade selection of teeth, in the present study Skin tone determinations were acquired from back of the hands as this area is supposed to be free of makeup or residues.

In the present study majority of the study participants had a dark skin tone. This finding is in accordance with the study done by Dosumu Oluwole O and Dosumu Elizabeth B [2] where they assessed the relationship between tooth colour, skin colour and age among patients at the Ibadan Dental School. The present finding is also in contrast with the study done by Azad Ali *et al.*, [4] where they investigated the possibility of a relationship between shades of teeth and

skin color on the basis of age and gender of the subjects in Armed Forces Institute of Dentistry, Rawalpindi (Pakistan), for a duration of six months. Accordingly most of the study subjects were medium skin toned.

In the present study most prevalent tooth shade among the study subjects was A1. This finding is in accordance with the study done by Nadeem Ahmad Rana *et al*., [6] where they identified tooth shades in various age groups of Pakistani population using VITA classical shade guide. The present finding in the study is also in accordance with the study done by Habab Osman Elamin *et al.*, [7] where they aimed to identify tooth shade among a group of Sudanese patients using Vita Easy shade. Results from the study revealed the most prevalent tooth shade among the study subjects to be A1.

In the present study, a positive correlation was observed between age and tooth colour. That is, as age increases the relative darkness of the tooth also increases. This finding is in accordance with the study done by Dosumu Oluwole O and Dosumu Elizabeth B [2] where they assessed the relationship between tooth colour, skin colour and age among patients at the Ibadan Dental School. Present finding is also in accordance with the studies done by Hallarman [8] and Jahangairi *et al*., [9] where they reported a significant association between age and tooth shade with older persons more likely to have teeth with lower value (darker).

In another study conducted in Japanese population, Hasegawa *et al.*, [10] found that lightness value of the teeth at the center site decreased linearly with advancing age. They attributed this to an earlier finding by Goodkind *et al.*, [11] It was seen that after the age of 35 years, teeth tended to become darker and more saturated in color at the center site, whereas the cervical site remained relatively unchanged in color, which may have been due to already thin enamel layer at the cervical portion of the teeth. In a recent study conducted by Hartmann *et al*., [1] it was suggested that probably it was darkening of the dentine core that led to an altered color in aged teeth. In a similar study conducted by Esan *et al*., [12] it was found that the percentage of lighter tooth shades decreased with age and that of darker ones increased with age within an age group. These results also support the findings of our study that tooth shade is influenced by age of the individuals.

In the present study, a negative correlation was observed between skin colour and tooth colour which was statistically significant. Current finding in the present study is in accordance with the study done by S Bhanu Rekha *et al*., [3] where they evaluate shade differences between natural anterior teeth in patients of different age groups, gender and skin tone of Pondicherry population using a digital camera and to subsequently feed the data into software to determine the shade guide. Studies done by Jahangiri L *et al*., [9] to evaluate the relationship between tooth shade value and skin color on multiracial population also showed an inverse relationship between tooth shade and skin color.

It is suggested that further research should be carried out with different shade guides available in the market to identify any other more accurate shade guide than the one used in our study. Furthermore, it is also suggested to fabricate a separate shade guide which is more representative of our local tooth shades, as in our study only 11 out of the available 26 shades were recorded. By having a custom made shade guide available pertaining to the population, it should be easier to find out the correlation between skin colour and tooth colour.

CONCLUSION

Within the limitations of this study, the following conclusions were drawn:

- A positive correlation was observed between age and tooth colour. That is, as age increases the relative darkness of the tooth also increases.
- A negative correlation was observed between skin colour and tooth colour.
- Most prevalent tooth shade among the study subjects was A1 in the present study

The results of this observational study suggest that there is a significant relationship between tooth shade and skin color. Based on the relationships skin color may be a useful guide for the selection of tooth shade in removable and full-mouth reconstructions achieve a more natural appearance, especially among the elderly and persons with darker skin tones.

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