

Differences in tooth shade value according to age, gender and skin color: A pilot study

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Abstract

Purpose of the Study: The purpose was to investigate the differences in tooth shade value according to age, gender and skin color among a sample of the local population in Bengaluru, India.

Methodology: The study comprised 100 subjects belonging to both gender between the age groups of 16 years to 55 years. Tooth shade values of permanent maxillary left or right central incisors were recorded using the Vitapan 3D-Master shade guide. Skin color was matched using the Radiance compact makeup shades as a guide.

Results: Chi-square statistical test demonstrated that younger subjects have lighter tooth shade values. No statistically significant differences were recorded in tooth shade value according to gender or skin color.

Conclusion: Within the limitations of the current study, it can be concluded that tooth shade value is significantly influenced by age. Gender and skin color appear not to have a significant relation to tooth shade value.

Key Words: Age, gender, skin color, tooth shade value

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INTRODUCTION

The word “Esthetic” meaning “concerned with beauty or the appreciation of beauty” is regularly used in dentistry to describe restorations and artificial teeth replacements. Increasing dental awareness among the general population in developing countries has led to increased demand for esthetic restorations. Hence, it becomes all the more pertinent now, more than ever before, to provide restorations which defy detection.

Selection of tooth shades based on natural anterior teeth is influenced by many factors. Light under which the shade

is viewed is a major factor.^[1] Clinical skill of the operator and shade guide system used, play an important role in the shade selection process.^[2] Staining due to various factors, both extrinsic and intrinsic, have a direct impact on altering tooth shades.^[3] Some of the extrinsic factors are diet, smoking, xerostomia, and restorations. Intrinsic factors include congenital defects of enamel or dentin such as amelogenesis and dentinogenesis imperfecta, environmental factors such as tetracycline staining, traumatic injury, dental caries, and aging.

In spite of all the factors mentioned above, the selection of artificial tooth shade to replace missing natural teeth is a relatively simple procedure when few natural anterior teeth remain. However, for the edentulous individual when no preextraction records are available, the choice of tooth shade is a subjective process.^[4]

A perception among dentists has been that individuals with darker skin colors have lighter shades of teeth.^[5] This

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perception is commonly explained by the illusion of greater contrast between skin color and tooth shade.

Age of the patient was found to have a definite relation with tooth shade value.^[6,7] This relation has been collaborated by many studies which have shown darker tooth shade values with an increase in age and vice versa.

Gender is yet another factor, significantly associated with tooth shade values.^[6] Men are more likely to present with darker tooth shade values whereas women of the same age group were more likely to show lighter tooth shade values.^[6]

Various studies have been conducted to establish a relation between age, gender and skin color of individuals with tooth shade values. Contrasting results have been reported.^[5,6] One of the reasons for varying results can be attributed to the ethnic origin of the study samples. Research in the field of esthetics and shade matching has been predominantly in the western population. However, with increasing dental awareness and demand for esthetics in developing countries like the Indian subcontinent, research in the field of esthetics based on a local population has become the need of the hour. In this study, the differences in tooth shade values according to age, gender and skin color was investigated among a sample of the local population in Bengaluru, India.

METHODOLOGY

The study consisted of a sample size of 100 individuals belonging to both genders. Individuals in the age range of 16 years to 55 years with at least one completely erupted permanent maxillary left or right central incisor were considered for this study. Permanent maxillary central incisors with carious lesions, restorations, endodontically treated teeth, intrinsic staining, extrinsic staining due to diet, smoking and tobacco/pan chewing, tooth wear or any tooth abnormality, xerostomia and history of tooth bleaching or radiation therapy were excluded from the study. The participants were further divided on the basis of chronological age into 2 groups of 50 each. Age groups were: Group I - 16–35 years; and Group II - 36–55 years.

The shade of middle third of the labial surface of permanent maxillary left or right central incisor was recorded using the Vitapan 3D-Master shade guide (Vita Zahnfabrik H Rauter GmbH Germany). All the shades were recorded by a single operator who had >5 years of clinical experience (VSK). The operator was made to undergo the Ishihara test^[8] for color blindness, and no color discrepancy was found.

The process of recording tooth shades was initiated after obtaining approval of the participants on the consent

forms provided to them. The operator recorded shades of not >3 subjects in a day to avoid fatigue. Shades were taken in natural daylight preferably between 10:00 am and 12:00 noon on days with clear skies. Individuals wearing facial makeup and/or lipstick were asked to remove them and were covered with a blue drape.

To avoid errors in shade recording due to dehydration, the subjects were asked to rinse their mouth with water prior to recording tooth shade. Subjects were viewed at eye-level, and all shade readings were made swiftly (5–7 s). Eyes were rested immediately after taking a shade reading by focusing on the blue drape for 5 s at a time. All readings were made from an arm's length. Shade tabs were moistened before recording the shade of the teeth. The lightness level (value) was selected. Starting from the darkest group, the appropriate value group – 1, 2, 3, 4 or 5 was recorded.

Next, skin color was matched using the Radiance compact makeup shades (manufactured by Lakme, India) as a guide. Skin color was divided into 3 categories: Light, medium and dark. Various shades of the makeup were arranged into corresponding skin color groups. This distribution was as follows: "Light" skin color group included the "natural pearl" shade of the makeup; "medium" skin color group included the "natural shell" and "dark" skin color group included the "Natural coral" of the makeup. Skin color determinations were acquired from back of the hands so that the area was free of makeup or residues.

RESULTS

This study comprised 100 individuals, out of which 68 were males and 32 were female. The distribution of subjects according to age group and gender is shown in Table 1.

When considering the shade value group in relation to gender, Chi-square statistical test indicated no significant difference between male and female subjects ($P > 0.05$). Shade value 2 was the most common value recorded among male (54.41%) and female (43.75%) as shown in Table 2.

Examining the value groups of the shade guide in relation to age groups, interesting results were found. In Group I - 64% recorded "Value 2" shades whereas in Group II - 38% recorded "Value 2" and 38% recorded "Value 3" shades each. Chi-square statistical test demonstrated highly significant difference between the two age groups with group II having higher proportion of subjects with darker tooth shade values ($P < 0.01$) as shown in Table 3.

Skin color in relation to the value groups of the shade guide demonstrated similar trends regarding tooth shades in "light, medium" and "dark" skin colors, whereby "Value 2" shades

was most common. Chi-square statistical test demonstrated no significant difference in tooth shade value according to skin color group ($P > 0.05$) as shown in Table 4.

DISCUSSION

Understanding the influence of factors such as age, gender and skin color on selection of artificial teeth in completely edentulous patients with no pre-extraction records, presents a unique challenge to dentists all over the world. Over the years, there have been many studies and recommendations on the use of aids and factors to assist the selection of artificial teeth for the edentulous individual.^[4] To fabricate complete dentures, the dentist must also rely on clinical judgment, together with the esthetic preferences of the patient and the shade of the available artificial teeth.^[2] The process of fabricating the prosthesis with an esthetically

pleasing color can be frustrating when the expectations of the patient do not match those of the dentist.^[9,10]

Furthermore, there is limited scientific information regarding the influence of factors like skin color on tooth shade selection in edentulous patients in the Indian subcontinent. Knowledge of this relationship can guide dentists in selecting artificial teeth for complete dentures that naturally complement the patient's face.^[2]

This study tried to establish a relationship between shade values of teeth with age, gender and skin color of individuals. This study can be considered a pilot study and the sample used was a convenience sample. It is in no way intended to represent the entire population of the subcontinent, in general.

From a clinical standpoint, the eye is very accurate in detecting homogeneities and variations in small surfaces.^[11] Visual shade matching is the most commonly used method by dentists in the Indian subcontinent. Shade matching can also be done using instruments such as spectrophotometers, photoelectric colorimeters and color scanners. Both techniques have inherent inaccuracies. Visual shade matching, however, is more cost effective and hence more widely used.

For tooth shade determination, the middle site of the tooth was used. The middle site of the teeth are 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.^[12]

The Vitapan 3D-Master shade guide^[13] used in this study consists of 11 sets of fired porcelain tooth-shaped samples. These samples are arranged in groups of two or three that form five sets (numbered 1 through 5). Each set represents a single value; 1 being the lightest tooth color and 5 the darkest. It is suggested that for best results, the shade guide should be held to the patient's mouth at arm's length^[14] and the light source should be diffuse, not direct, and use of natural light is best. Tooth color should be matched swiftly to avoid fatiguing of the cones of the eye and patients should be viewed at eye level so that the most color-sensitive part of the retina was used.^[15] The use of a light blue drape is helpful^[14] and serves two purposes.

- It helps to cover any bright clothing worn by the patient
- It allows the operator to rest his eyes between shade recordings.

The results of the study show that there is a significant relationship between shade values of teeth and the age-groups selected. It was noted that with increasing age, there was a tendency for the teeth to be of darker shades. This can be attributed to the fact that there is secondary dentin formation

Table 1: Distribution of patients according to age group and gender

| Age group | Gender (%) | | Total (%) |
|-----------|------------|---------|-----------|
| | Male | Female | |
| Group I | 35 (70) | 15 (30) | 50 (100) |
| Group II | 33 (66) | 17 (34) | 50 (100) |
| Total | 68 (68) | 32 (32) | 100 (100) |

Table 2: Distribution of patients according to the shade value group and gender

| Shade value group | Male n (%) | Female n (%) | Total | χ^2 | P |
|-------------------|------------|--------------|-------|----------|-------|
| Shade value 1 | 14 (20.59) | 12 (37.50) | 26 | 3.248 | 0.197 |
| Shade value 2 | 37 (54.41) | 14 (43.75) | 51 | | |
| Shade value 3 | 17 (25.00) | 6 (18.75) | 23 | | |
| Shade value 4 | 0 (0.00) | 0 (0.00) | 0 | | |
| Shade value 5 | 0 (0.00) | 0 (0.00) | 0 | | |
| Total | 68 (100) | 32 (100) | 100 | | |

Table 3: Distribution of patients according to the shade value group and age group

| Shade value group | Age group n (%) | | Total | χ^2 | P |
|-------------------|-----------------------|------------------------|-------|----------|--------|
| | Group I (16-35 years) | Group II (36-55 years) | | | |
| Shade value 1 | 14 (28) | 12 (24) | 26 | 20.657 | 0.002* |
| Shade value 2 | 32 (64) | 19 (38) | 51 | | |
| Shade value 3 | 4 (8) | 19 (38) | 23 | | |
| Shade value 4 | 0 (0) | 0 (0) | 0 | | |
| Shade value 5 | 0 (0) | 0 (0) | 0 | | |
| Total | 50 (100) | 50 (100) | 100 | | |

Significance level $P < 0.01$, * denotes significant difference

Table 4: Distribution of patients according to the shade value group and skin color

| Shade value group | Skin color n (%) | | | Total | χ^2 | P |
|-------------------|------------------|------------|------------|-------|----------|-------|
| | Light | Medium | Dark | | | |
| Shade value 1 | 5 (23.81) | 14 (28.57) | 7 (23.33) | 26 | 4.246 | 0.374 |
| Shade value 2 | 14 (66.66) | 21 (42.86) | 16 (53.33) | 51 | | |
| Shade value 3 | 2 (9.53) | 14 (28.57) | 7 (23.33) | 23 | | |
| Shade value 4 | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 | | |
| Shade value 5 | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0 | | |
| Total | 21 (100) | 49 (100) | 30 (100) | 100 | | |

after the age of approximately 35 years,^[16] coupled with thinning of enamel due to tooth wear. Hasegawa *et al.*^[7] observed that the natural tooth color showed a significant decrease in lightness at the center to cervical site and increase in yellowness with advancing age. Similar correlation was reported by Jahangiri *et al.*,^[5] where a significant association was found between tooth color and age of the patients, in that with advancing age, teeth tended to become darker in color. In a similar study conducted by Esan *et al.*,^[6] 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. The findings of this study are in coherence with the results of the above-mentioned studies.

When considering the shade values of teeth in relation to gender, it was found that there was no statistically significant association between tooth shade and gender in the study sample. This may be due to the imbalance in the ratio of male to female subjects in the sample of this study. However, Esan *et al.*,^[6] indicated that gender is significantly associated with tooth shades, in that men are more likely to present with darker tooth shades whereas women of the same age group were more likely to show lighter tooth shades.

It has been suggested the color of the face should be the basic guide to tooth color.^[5] Specifically, it is suggested the value of the teeth must correspond to darkness or lightness of the facial skin color.^[5] However, this study found no statistically significant association between tooth shade values and skin color. A disagreement between the results of this study and previous studies may be due to variations in sampling methods employed and also due to the fact that there are no sharp contrasts between various skin colors in the local population considered for this study. This finding is well-supported by Esan *et al.*,^[6] who found no significant relationship between facial skin color and tooth shade. However, the results of this study did not agree with the findings of Jahangiri *et al.*,^[5] who found significant inverse relationship between tooth shade value and skin color.

CONCLUSIONS

Within the limitations of the current study, it can be concluded that tooth shade value is significantly influenced by age. Gender and skin color appears not to have any significant relation

to tooth shade value. Future research with a larger and more representative sample in relation to age and gender groups of the subcontinent population is needed to confirm the findings of this work.

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