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The Distribution Of The Upper Frontal Teeth Shades Depending On Gender, Age, Skin And Eyes Colors

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ABSTRACT

Tooth shade is one of the more important factors in dental and facial esthetics. The aim of this study was the determination of tooth shades of the upper frontal teeth in subjects and comparison with different gender, age, skin and eyes colors. Subjects tooth color measurements were determined using an intraoral spectrophotometer Vita Easyshade® (Vita Zahnfabrik. H Rauter GmbH & Co. KG. Bad Sackingen. Germany). The measurements were made in 255 patients in the intercanine sector of maxilla. The colors of skin and eyes were determinate with visual perception. From the spectrophotometer were registered the shades of the Vita Tooth Guide 3D Master (Vita Zahnfabrik, H Rauter GmbH & Co, KG, Bad Sackingen, Germany). The Pearson Chi-square test was used to observe the differences between teeth color and gender, age, skin, eyes color. In the central incisors the most frequent shade was registered 2M1 in 62 subjects (8.10%), in lateral incisors 1.5M1.5 in 65 (8.50%) and in canines 2M3 in 142 subjects (18.56%). The Pearson Chi-square test results. showed that there was a significant statistical difference in relation central incisor to gender, age, skin and eyes color ($p<0.01$; $p<0.001$); in lateral incisors $p<0.001$ and in canines $p<0.001$ ($p=0.001$). Whereas, in the relation lateral incisors and canines to eyes color ($p>0.05$) there was not a statitical significant difference. The gender, age, skin and eye color significantly correlate with the tooth color, except in the relation lateral incisors and canines to eyes color.

Keywords: age, eyes color, gender, teeth color, skin color.

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INTRODUCTION

The color of teeth is strongly determined by dentin. with more translucent enamel playing a lesser role through scattering at wavelengths in the blue range.[1] The tubules are the predominant cause of light scattering in dentin and in enamel the hydroxyapatite crystals contribute significantly to scattering.[2]At the outermost incisal and proximal edges of teeth, the layer of enamel is backed only by its own curved surface; because of the interfacial reflection caused by the change in index of refraction, this surface acts as a condensing mirror focused on the dentin.[3] A lot of authors reported that color matching is difficult and the results are inadequate (Clark 1931. Sproull 1973, McLean 1979, Preston and Bergen 1980. Preston 1985). [4-8] The use of unsuitable shade guides (Preston 1985, Seluk and LaLonde 1985) for colour selection adds to the problems making consistent color matching impossible. [8,9] Existing shade guides are unsuitable (Sproull 1976)[10] as the shades do not conform to tooth color (Sproull 1973. Lemire and Burk 1975)[5,11] and there is a lack of any organized distribution of the samples (Sproull 1973, McLean 1979, Preston 1985)[5,6,8]. As well they are constructed in different materials and the colors do not match the restorative material (Preston 1985)[8]. Prosthodontists, in their everyday routine are faced with the harmonizing tooth shade with facial appearance in fully edentulous patients or complete fixed appliances. Authors Dosumu O and Dosumu E, suggest that the color of the teeth must harmonize with the surrounding environment such as skin, hair, eye color and age all with the aim of enhancing facial appearance.[12] The color of the restorations is a significant factor affecting dental appearance of maxillary anterior teeth in patients and therefore the clinician has to be very careful in choosing the right one using reliable tools.[13]The knowledge of human tooth color and its distribution are very important in aesthetic dentistry [14]Tooth color has an influence on aesthetics and it is important for social rehabilitation of denture wearers (Jahangairi et al 2002; Millar et al. 1993).[15,16] Sykora, concluded that during the determination of the color of posterior teeth should be based on premolars and for anterior teeth in upper central incisors [17] The denture aesthesis has been defined as “the cosmetic effect produced by a dental prosthesis which affects the desirable beauty, attractiveness, character and dignity of the individual. [18]

Based on Veeraganta, it can be concluded that tooth shade value, is significantly influenced by age. Chi-square statistical test demonstrated that younger subjects have lighter tooth shade values.[19] According to, Richardson the illusion of greater contrast between skin color and tooth shade explains the visual perception, that individuals with darker skin colors have lighter shades of teeth.[20] Lagouvardos et al., concluded that teeth color was not related to eye color, but persons with lighter teeth, were found to be associated with lighter skins and redder lateral incisors to lighter hair. Darker facial skins or yellower forehead areas were also associated with darker hair and vice versa. [21]

The measurement of teeth color remains a challenge. Therefore, a thorough understanding of appearance attributes of natural teeth is required along with new shade guides and shade taking instruments to maximize shade – matching results. [22]

Spectrophotometers are amongst the most accurate, useful and flexible instruments for color matching in dentistry [23,24]

Compared with visual perceptions by the human eye, or conventional techniques, it was found that spectrophotometers offered a 33% increase in accuracy and a more objective match in 93.3% of cases. [25]

The Vita company, introduced the 3D Master shade guide, with the aim of accurately assessing shade according to the three components of color: hue. lightness and chrome. Also, in this guide the tabs are arranged systematically and logically, rather than randomly, as in the previously used guides (Vitapan Classical). The 3D-Master guide represent the multi-layers of natural teeth. Vita Lightness, Vita Chroma and Vita Hue, similarly to the Munsell hue, lightness and chroma color co-ordinates, which represent the three dimensions of color. The tabs are grouped into five categories, sequentially numbered, with an increasing lightness value (1, 2, 3, 4 and 5). All tabs within a lightness group have the same brightness. In a given lightness group, the chrome increases from top to bottom. All groups, with the exception of 1 and 5, are designated three letters L, M and R, corresponding to varying hue. For example, L (left) is indicative of a yellow, M (medium) of a yellow–red or orange and R (right) of a red hue. In the samples are comprised the number/letter/number configuration. The first number indicates the value group (1 to 5), the letter is the hue (L, M or R) and the second number the chroma (1, 1.5, 2, 2.5 or 3). For example, 2M2 corresponds to the

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second lightness group, the M hue sub-group and a 2-chroma level. For an intermediate tooth shade, a combination of two tabs is used for the final color prescription.

Vita Easyshade, is a handheld spectrophotometer for tooth shade matching. The instrument consists of a handpiece and a base unit, which are connected by a monocoil fiberoptic cable assembly. This device provides accurate shade determination for natural and bleached teeth and a variety of restorations. Easyshade displays its output on a touch – screen that is also used to make menu selections and enter –data. It has the capability to measure the color in the vestibular thirds including cervical, middle and incisal area. [26]

Due to the fact that teeth color changes with age and gender, also having in mind the relation between teeth color, eye and skin color, the aim of this study was the determination of tooth shades of the upper frontal teeth and comparison with different gender, age, skin and eyes color.

MATERIAL AND METHODS

This study analyzed the teeth color, measured by a spectrophotometer in different age, gender, skin and eyes color. The measurements were made in 255 subjects (females 130 and males 125), in the intercanine sector of maxilla. at Kosovo Albanian population, in the University Clinical Center of Kosovo. The participants fell in age group 20 - 29; 30 - 39 and 40 – 49 years. Skin color was divided into three groups: light, medium and dark skin. The eyes colors were categorized into four groups: brown eyes, green eyes, blue eyes, very dark brown.

There were analyzed 765 left teeth from the midline of maxilla (central incisors, lateral incisors and canines). The subjects' teeth color measurements, were determined using an intraoral spectrophotometer Vita Easyshade® (Vita Zahnfabrik. H Rauter GmbH & Co, KG, Bad Sackingen, Germany), **Fig.1**.

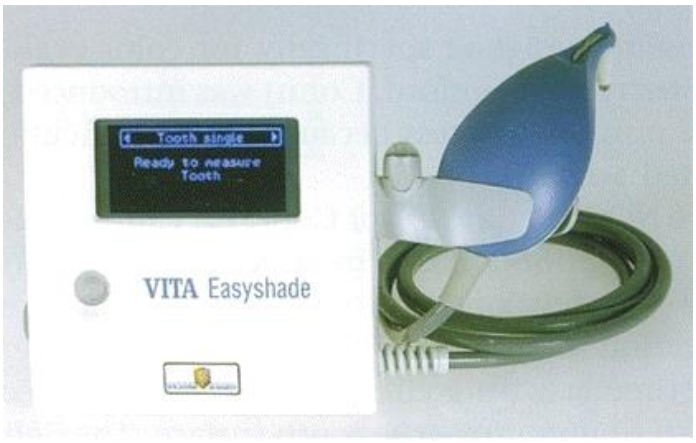

Fig 1: Intraoral spectrophotometer Vita Easyshade®

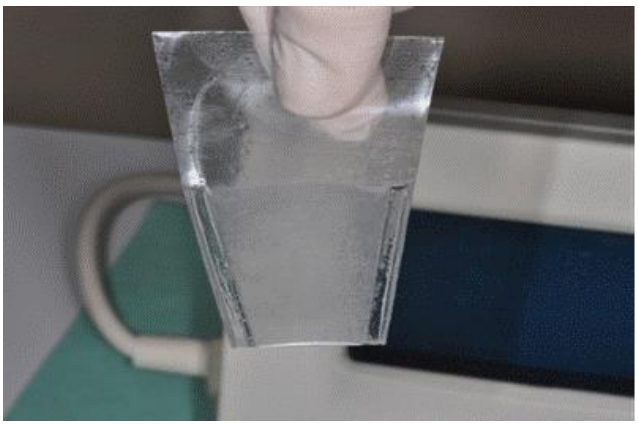

Fig 2: The Infection Control Shield

From the spectrophotometer were registered the shades of Vita Tooth Guide 3D Master (Vita Zahnfabrik. H Rauter GmbH & Co, KG, Bad Sackingen, Germany). The color of skin and eyes were determinated with visual perception. The Pearson Chi-square test was used to observe the differences between teeth color and gender, age, skin, eye color.

In this study, were included only patients with natural teeth, without any fillings, stains and non-smokers. Before the color measurement, teeth were polished with tooth paste and brush. After that, Vita Easyshade has turned on and the lamp has warmed up. The Infection Control Shield was inserted to the probe tip, **Fig.2.**

After the calibration, the normal measurement mode was used, which gives a possibility to measure the base shade of a tooth, with the selection of "Tooth Single" on the measurement style menu. The probe tip was holed at 90˚, to the third middle segment of vestibular surface of the tooth, **Fig.3,4.** The 3D Master shades were collected.

Fig 3: The probe tip of the spectrophotometer

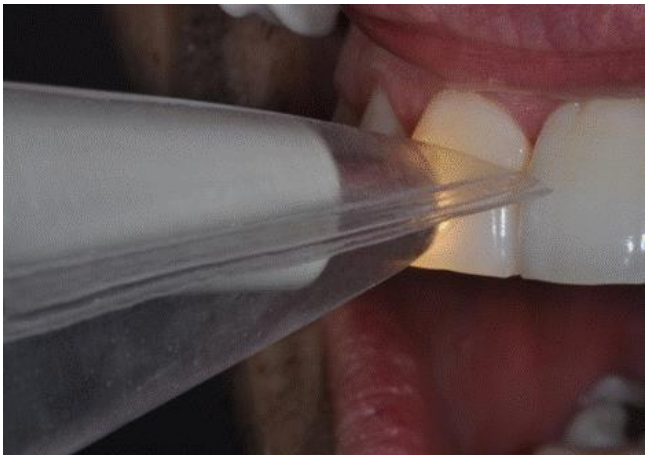

Fig 4: The probe tip of the spectrophotometer was holed at 90˚, to the third middle segment of vestibular surface of the tooth.

The statistical analyze, was performed through statistical program STATISTICA 7.1.

RESULTS

In 255 subjects the total number of analyzed teeth was 765, from which 408 teeth were analyzed in females (53.33%) and 357 teeth (46.67%) in males. The participants fell in age group 20 - 29 or 294 (38.43%); 30 - 39 or 231 (30.20%) and 40 – 49 or 240 (31.37%).

In the central incisors the most frequent shade was registered 2M1, in 62 subjects (8.10%). The shades that were registered rarely were: 3.5M2.5(0.13%), 4M1(0.13%), 4M2.5(0.13%), 1M1.5(0.13%), 2.5M2(0.13%), 3L2.5(0.13%) and 2R2(0.13%).

In the lateral incisors the most frequent shade was registered 1.5M1.5 in 65 subjects (8.50%). The shades that were registered rarely were: 4M1(0.13%),3R2.5(0.13%), 2.5M1.5(0.13%), 2L1.5(0.13%) and2.5M2(0.13%).

In the canines the most frequent shade was registered 2M3, in 142 subjects (18.56%). The shades that were registered rarely were: 4M1(0.13%),2.5R2(0.134%), 4M3(0.13%), 4R1.5(0.13%)and3M2.5(0.04%).

Table 1: summarizes the distribution of tooth shades for central incisors, lateral incisors and canines,in different genders. In the central incisors for x^2=73.12 and p<0.01 (p=0.002), there was a significant statistical difference. Also,lateral incisors with results of 99.01, df=41, p=.001, showed that,there was a significant statistical difference. The relation with gender in canines was 89.44, df=45, p=.001, which once again shows that there was significant statistical difference.

Table 1: The tooth shades and distribution / Gender

Pearson Chi-square: 73.12. df=41. p=.002/ Central incisor Pearson Chi-square: 99.01. df=41. p=.001/ Lateral incisor Pearson Chi-square: 89.44. df=45. p=.001/ Canine				
	Spectrophotometer	Gender F	Gender M	Total
Total	0.5M2-4M3 2L1.5-4L2 2R2-4R2.5	408	357	765
%	/	53.33%	46.67%	100%

In table 2. was shown the distribution of tooth shades in the central incisors, lateral incisors and canines of maxilla, in relation with the age. For x^2=287.02 and p<0.001 (p=0.000) in central incisors, in the shown distribution, there was a significant statistical difference. For lateral incisors x^2=231.76 and p<0.001 (p=0.001) and canines x^2=221.14 and p<0.001 (p=0.001), there was also a statistical significance.

Table 2: The tooth shades and distribution /Age

Pearson Chi-square: 287.02. df=82. p=0.000/Central incisors Pearson Chi-square: 231.76. df=82. p=.001/Lateral incisors Pearson Chi-square: 221.14. df=90. p=.001/Canines					
	Spectrophotometer	Age 20 - 29	Age 30 - 39	Age 40 - 49	Total
Total	0.5M2-4M3 2L1.5-4L2 2R2-4R2.5	294	231	240	765
%	/	38.43%	30.20%	31.37%	

In table 3.,was presented the relation between skin color and tooth shades in central incisors, lateral incisors and canines.

The results for central incisors were x^2=179.72 and p<0.001 (p=0.000); for lateral incisors 179.43, df=82. p=.001 and for canines 127.42, df=90. p=.006. In the distribution, between skin color and tooth shades, there was a statitical significant difference.

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Table 3: The tooth shades and distribution /Skin color

Pearson Chi-square: 179.72. df=82. p=.000/ Central incisors Pearson Chi-square: 179.43. df=82. p=.001/Lateral incisors Pearson Chi-square: 127.42. df=90. p=.006/ Canines					
	Spectrophotometer	Skin color Light	Skin color medium	Skin color dark	Total
Total	0.5M2-4M3 2L1.5-4L2 2R2-4R2.5	189	501	75	765
%	/	24.71%	65.49%	9.80%	

In table 4. was presented the relation between the eyes colors and tooth shades. The results for relation between central incisors and eyes colors was x^2=210.71 and p<0.001 (p=0.000) in the distribution there was a statitical significant difference.

The results for relation between lateral incisors and eye color were x^2=137.53 and p>0.05 (p=0.18) and this shows that in the distribution there was not a statitical significant difference. The relation between canines and eyes colors were x^2=142.16 and p>0.05 (p=0.18). In the shown distribution there was not a statitical significant difference.

Table 4: The tooth shades and distribution /Eyes colors

Pearson Chi-square: 210.71. df=123. p=.000/ Central incisors Pearson Chi-square: 137.53. df=123. p=.18/Lateral incisors Pearson Chi-square: 142.16. df=135. p=.32/ Canines						
	Spectrophotometer	Brown eyes	Blue eyes	Green eyes	Very dark brown	Total
Total	0.5M2-4M3 2L1.5-4L2 2R2-4R2.5	426	96	210	33	765
%	/	55.69%	12.55%	27.45%	4.31%	100%

DISCUSSION

The study was designed to explore the relationship, between natural tooth shades, gender, age, skin and eyes colors. From the 3D Master shade guide, results of Easyshade measurements for the central incisors showed that the most frequent shade was 2M1,in lateral incisors 1.5M1.5and in canines 2M3.

From the literature we can see that exists a relation, between ethnic background and tooth shade.[27]Cristina Gómez-Polo et al., concluded that the most frequent color among the Spanish population is 3M1. They also represent the most common color parameters according to the 3D Master System in the Spanish population and concluded, as follow: lightness group was 2; the most frequent hue group was M and the most frequent chroma group was 1.5.[28] Comparing with the results of this study, it can be said, that the Spanish and Albaniaan population of Kosovo are part of the M group and this fact can be explained, that these two populations belong to the same neutral colors, with different group of lightness and the same intensity of the chrome intensity.

Rodrigues et al. concluded that the most common shade for the maxillary and mandibular incisors in the younger age group was 2R1.5 and 1M2 for the males and females, using Vita 3D Master shade guides, respectively. In the advanced age, the most common shade for the maxillary and mandibular incisors was 2R2.5. However, they reported for no statistical significance between males and females in different age groups using different shade guides. Although, the incidence of males with darker teeth, as compared to females, was higher; the study showed no statistical significant correlation between shade differences in both the sexes. It is also observed, that there is a significant darkening of teeth as the age advances. [29] In this

study between central incisors, lateral incisors and canines of maxilla, in relation with the gender and age, there was a statistical significant difference ($p<0.001$).

Veeraganta, concluded that tooth shade value is significantly influenced by age. In this study the results of Chi-square statistical test, demonstrated that younger subjects have lighter tooth shade values. [19] As concerned gender or skin color these authors did not find any statistically significant differences according to tooth shade value.

Based on Goodkind and Schwabacher,women's teeth in general were lighter, less chromatic and less reddish-colored than men's; aging produced darker and more reddish teeth.[30]

Whereas Dosumu O and Dosumu E, did not find any significant association between tooth shade and skin color nor between tooth shade and gender,($p<0.05$). [12]These findings do not correspond with the results of this study. In the relation between central incisors and eyes colors $p<0.001$ ($p=0.000$) there was a statitical significant difference. Also, between lateral incisors and skin color there was a significant statistical difference $p<0.01$. However, no significant association was found between tooth shade in lateral incisors and canines to eyes colors $p>0.05$.

Based on conclusions of Hassel et al.,teeth and eyes colors coordinates were not correlated ($p > 0.05$). [31]The other study, which investigated facial characteristics concluded that these characteristics are inter-correlated weakly to moderately, and for this reason predicting the color parameters of one facial characteristic by another would not be accurate, but helpful for a rough color selection as associations show.[22]

The Saudi Arabian, East Asian, and Indian groups had positive linear correlation with the lightness value between tooth and skin color. [32]A significant correlation was found between tooth and skin color.

CONCLUSION

- The tooth shades in the central incisors in relation with age, gender, skin color and eyes colors, showed that there is a significant statistical difference. The most frequent shade in the central incisors was 2M1.
- The tooth shades in the lateral incisor in relation with age, gender, skin color, showed, that there is a significant statistical difference. The most frequent shade in the lateral incisors was 1.5M1.5. Whereas, the relation between eye color and lateral incisors showed that there is not a significant statistical difference.
- The tooth shades in the canines, in relation with age, gender, skin color showed that there is a significant statistical difference. The most frequent shade in the lateral incisors was 2M3. Whereas, the relation between eye color and canine showed that there is not a statistical significance.

CLINICAL IMPLICATIONS

- Teeth color of prosthodontic appliances, must harmonize with the factors, such as gender, age, skin and eyes colors. The shades obtained from the intercanine sector (2M1, 1.5M1.5 and 2M3), might be as a guide for shade selection for prosthodontic appliances. The most frequent group from Hue was M, which tells us that during the teeth color determination we should be concentrated more into the neutral shades, from the Vitapan 3D-Master shade guide.

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REFERENCES

[1] ten Bosch JJ, Coops JC: Tooth color reflectance as related to light scattering and enamel hardness. J Dent Res. 1995; 74:374.
[2] Vaarkamp J, ten Bosch JJ, Verdonschot EH: Propagation of light through human dental enamel and dentine. Caries Res. 1995; 29:8.
[3] Houwink B: The index of refraction of dental enamel apatite. Br Dent J. 1974,137:472.
[4] Clark EB. An analysis of tooth color. J Am Dent A. 1931; 18: 093.
[5] Sproull RC. Color matching in dentistry. Part I. J Pros Dent 1973; 29: 416-424.
[6] McLean JW. The science and art of dental ceramics. Vol 1: The nature of dental ceramics and their clinical use. Chicago: Quintessence Publishing Co Inc.; 1979.
[7] Preston JD, Bergen SF. Color science and dental art. St. Louis: CV Mosby; 1980.
[8] Preston JD. Current status of shade selection and color matching. Quint Int 1985; 1: 47-58.
[9] Seluk WL, LaLonde TD. Esthetics and communication with a custom shade guide. Dent Clin Nth Am 1985; 29: 741-51.
[10] Sproull RC, Color matching problems in dentistry. In: ISCC Subcommittee for Problem 35 Report. Color Res Appl 1976; 1:134-136.
[11] Lemire PA, Burk AAS. Color in dentistry. Hartford: JM Ney Co.; 1975.
[12] Dosumu Oluwale O and Dosumu Elizabeth B: Relationsheep between tooth color, skin, color and age. Afr. J. Biomed.2010; 9-14.
[13] Kristek Zorić E, Žagar M, Knezović Zlatarić D. Influence of Gender on the Patient's Assessment of Restorations on the Upper Anterior Teeth. Acta Stomatol Croat. 2014;48:33-41.
[14] O'Brien W J, Hammendinger H, Boenke KM, Linger JB, Groh CL. Color distribution of three regions of extracted human teeth. Dent mater. 1997; 13: 179 -85.
[15] Jahangairi L, Reinhardt SB, Mehra RV, Matheson PM. Relationship between tooth shade value and skin color: An observational study. J Prosthet Dent. 2002; 87:149–152.
[16] Millar A, Long J, Cole J, Staffanou R. Shade selection and laboratory communication. Quintessence Int.1993; 24: 305-309.
[17] Sykora O. Fabrication of a posterior shade guide for removable partial dentures. Journal of Prosthetic Dentistry.1993; 50: 287-288.
[18] Otuyemi OD, Ogunyinka A, Dosumu O et al. Perceptions of dental aesthetics in the United States and Nigeria. Community Dent Oral Epidemiol.1998; 26:418-20.
[19] Veeraganta SK, Savadi RC, Baroudi K, Nassani MZ. J Indian Prosthodont Soc.Differences in tooth shade value according to age, gender and skin color: A pilot study. 2015; 15:138-41.
[20] Richardson ME. By their teeth shall ye know them. BDJ. 2001; 191:459-464.
[21] Lagouvardos PE, Tsamali I, Papadopoulou C, Polyzois G. Tooth, skin, hair and eye colour interrelationships in Greek young adults. Odontology. 2013; 101:75–83.
[22] Cho BH, Lim YK, Lee YK. Comparison of the color of natural teeth measured by a colorimeter and Shade Vision System.Dent Mater. 2007; 23:1307-12.
[23] Paul SJ, Peter A, Rodoni L, Pietrobon N. Conventional visual vs spectrophotometric shade taking for porcelain-fused-to-metal crowns: a clinical comparison. Int J Periodontics Restorative Dent.2004; 24:222-31.
[24] Lehmann KM, Devigus A, Igiel C, Wentaschek S, Azar MS, Scheller H. Repeatability of color-measuring devices. Eur J Esthet Dent. 2011; 6:428-35.
[25] Chu SJ, Trushkowsky RD, Paravina RD. Dental color matching instruments and systems. Review of clinical and research aspects. J Dent. 2010;38:2-16.
[26] Paravina RD, Powers JM. Esthetic Color Training in Dentistry. 2004; St Louis, Mosby.
[27] Elamin HO, Abubakr NH, Ibrahim YE. Identifying the tooth shade in group of patients using Vita Easyshade. Eur J Dent. 2015; 9:213-7.
[28] Cristina Gómez-Polo,Miguel Gómez-Polo,Juan Antonio Martínez Vázquez de Parga,Alicia Celemín Viñuela. Study of the most frequent natural tooth colors in the Spanish population using spectrophotometry. J Adv Prosthodont. 2015; 7:413-422.
[29] Rodrigues S,Shetty SR,Prithviraj DR. An evaluation of shade differences between natural anterior teeth in different age groups and gender using commercially available shade guides.
[30] Goodkind RJ. Schwabacher WB: Use of fiber-optic colorimeter for in vivo color measurement of 2830 anterior teeth. J Prosthet Dent. 1987; 58:535.

[31] Hassel AJ, Nitschke I, Dreyhaupt J, Wegener I, Rammelsberg P, Hassel JC. Predicting tooth color from facial features and gender: results from a white elderly cohort.J Prosthet Dent. 2008;99:101-6.
[32] Satheesh B, Haralur, Ahmed Mohammed Dibas, Nabil Abdullah Almelhiand Dhafer Ali Al-Qahtani. The Tooth and Skin Colour Interrelationship across the Different Ethnic Groups International Journal of Dentistry.2014, Article ID 146028, 6 pages http://dx.doi.org/10.1155/2014/146028.Research Article.