

# MOST FREQUENTLY SELECTED SHADE FOR ADVANCE RESTORATION DELIVERED IN A TERTIARY HOSPITAL FACILITY IN SOUTH WESTERN NIGERIA

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## ABSTRACT

**Background:** Bulk purchase of Porcelain materials with some in less use and expiring before being exhausted has resulted in colossal economic loss in the past and present in our environment. Having knowledge of prevalent shade in this environment will minimize this loss.

**Objectives:** The study aimed at auditing the shade selection and identifying the most frequently selected shade for advanced restoration in the Conservative Dentistry Clinic as well as assessing the influence of gender and age on choice of shade selected.

**Methods:** This is a retrospective study of shade selection for advanced restorations fabricated over a period of seven years in the University College Hospital Dental Clinic spanning January 2009 to December 2016. Data collected which was analyzed using the SPSS Version 22, includes: Socio demographic data, oral hygiene status and social habits, designation of the doctors that took the shade, types of advanced restorations, tooth/teeth restored, shades selected and types of shade guides used if indicated.

**Results:** The outcome of the study showed that 'A' group shades were more chosen for advance restorations (50.6%). However, Vita shade A3 was the most selected of all the shades, while shade C4 was the least selected. Lighter shades of 'A' were more frequently selected in female patients (57%) while shade 'D' were chosen in the greater percentage of male patients (60%). Younger age groups less than 45years old tend to have lighter shade selected for their restorations. (Fig. 2).

**Conclusion:** Vita shade A3 (3M3) was the most frequently selected shade for aesthetic advanced restoration. Lighter shades are generally selected more in the female patients and younger age group.

**Keywords:** Shade selection, Shade guide, Advance restoration

## INTRODUCTION

The perception of colour and appearance of teeth is a complex phenomenon, with numerous factors such as lighting conditions, translucency, opacity, light scattering, gloss and the human eye and brain affecting the overall outcome of tooth colour.<sup>1,2</sup> Any slight change in shade from the natural may play with our eyes, our minds and our dentistry at large.<sup>3</sup> Therefore, selecting the proper porcelain shade and colour match of ceramic restoration to natural dentition is still one of the most difficult and frustrating problems in fixed prosthodontics.<sup>4</sup> However, progressive research on the visual system has helped us with better insight into how colour discrimination is influenced by environment, disease, drugs and aging.<sup>5</sup>

The fundamentals of colour and light, the radiation spectrum and the optical characteristics of the object is to be well understood prior to evaluating and selecting the correct colour shade for the restoration. To provide

the patient with an aesthetically acceptable restoration, the scientific basis of colour as well as the artistic aspect must be considered. To describe colour in dentistry certain systems are used for clinical and research purposes which include The Munsell colour order system, the CIE L\*a\*b\* (CIELAB), CIE L\*c\*h\* colour Coordinate systems and the RGB (red, green and blue) system.<sup>6</sup> The CIELAB system was developed in 1976 by the Commission Internationale de l'Eclairage (CIE) to produce a uniform colour space. The CIELAB system L\* value measures lightness which correspond with the value (V) in the Munsell colour order system. The metric chroma [ $C^*_{ab} = \sqrt{a^2 + b^2}$ ] and hue angle ( $h_{ab} = \tan^{-1}(b/a)$ ) can be derived from the a\* and b\* values as defined by CIE (1986). Metric chroma is represented as the radial distance of the colour coordinates (a\*b\*) for the L\* axis. The hue angle ( $h^{\circ}_{ab}$ ) is represented by the angle of the radial

line joining the L\* axis to the colour coordinates (a\*, b\*) measured from the a\* axis.<sup>7</sup>

Clinical determination of tooth colour is possible by the use of a variety of methods such as visual assessment with shade guides, as well as instruments; spectrophotometers, colorimetric and computer based analysis of digital images.<sup>4,8</sup> The first shade guide was introduced in 1956 by Vita Zahnfabrik. The most popular shade guides are VITA Classical, Chromascope, Vitapan 3D Master shade guide. VITA classical shade guide consist of 16 tabs, arranged into four groups based on the hue and within the group according to increasing Chroma. Hue is categorized by letter i.e., A = Orange, B = Yellow, C = Yellow/Gray and D = Orange/Gray. Chroma and Value are categorized by numbers. Vita System 3D-Master comprises 26 samples ranging from lightest to darkest value, from lowest to highest intensity and from yellow to red. The tabs are grouped into 5 categories, numbered in sequence with increasing value (1-5). All tabs within the value group have the same brightness. The chroma increases from top to bottom in each of the groups. All the groups except 1 and 5 have 3 letters: L, M, R, which allows the hue to be chosen. L (light) is yellow, M (medium) is yellow-red, and R is a red hue. This shade is documented with a number/letter/number system in which the first number indicates the value group (1-5), letter is the hue (L, M, R) and the chroma (1-3). E.g. 3M2 is the 3rd value group, M hue subgroup, and 2 chroma levels.<sup>3</sup>

Meanwhile, adequate knowledge of the distribution of shades chosen for definitive metal ceramic crowns in the past may be a useful auxiliary in shade selection especially for the inexperienced operators.<sup>3</sup> Emphasis regarding 'aesthetic standard' on media has probably led to the most recent advances in shade matching.<sup>2</sup> With more research and new technologies, there is possibility of achieving a greater percentage of successful match than what we have currently.<sup>2</sup>

Different range of shades exists for shade guide used in the dental Clinics and Dental Laboratories depending on the manufacturers of the shade guide. Distribution of the shade selected for advance restorations may differ from one clinic to the other which may be influenced by a number of factors such as the type of shade guide, experience of the operator, technique and light condition of the operatory.<sup>9</sup> The results of some research indicate that the most frequently chosen shades in their clinics were in the mid-range of reddish-brown hue, but shades in the reddish-grey range of hue were rarely chosen.<sup>10</sup> However, it has been shown that there was a statistically significant difference between the different individuals with respect to tooth shade

selection ability.<sup>11</sup> There may be need for blending of more than one shade in certain situations. Although, the selection of more than one shade for a crown ("mixed shades") was generally restricted to the maxillary anterior teeth,<sup>10</sup> perhaps being the most visible teeth in the aesthetic zone of the mouth.

Factors such as gender and visual abnormality of operator may affect the selection of shade for advance dental restorations. It has been reported that irrespective of the color difference metric, the shade selection carried out by female operators showed greater success compared to males.<sup>12</sup> This is probably due to the fact that colour vision anomaly is more prevalent in male than female which may affect shade selection.

Dental materials generally have expiry date, and if they are not used within this time, they must be discarded. It is therefore important to avoid overstocking as it costs money and increases wastage.<sup>13</sup> Purchasing of some materials such as porcelain powder containing 16 shades with some of the shades not commonly used may result to long time in storage extending beyond the expiry date. This may lead to wastage of such materials. Having knowledge of the common shade of porcelain being used and stocking it based on that will minimize such wastage.

## AIM AND OBJECTIVES

This study aimed at auditing shade selection and identifying the most frequently selected shades for advanced restorations delivered over a period of seven years. Also to find out if there is any influence of gender and age on the choice of shade selected.

## MATERIALS AND METHODS

This is a retrospective cross sectional study of shade selection for advanced restorations fabricated over a period of seven years in the University College Hospital Dental Clinic spanning January 2009 to December 2016. Case files of all the patients that had advanced restorations done within the period were retrieved from the record unit of the hospital. Data collected which was analyzed using the statistical package for social sciences Version 22, included: Socio demographic data (such as, registration number, age, sex, tribe, occupation, level of education attained and address), oral hygiene status and social habits, designation of the doctors that took the shade, types of advanced restorations, tooth/teeth restored, shades selected and types of shade guides used if indicated.

## RESULTS

The shade guide used for the shade selection in this study was Vita classical shade guide. The outcome of

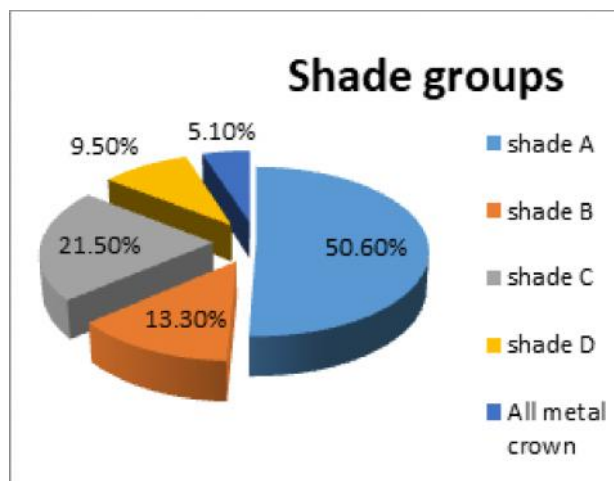
**Table 1:** Frequency distribution of shade selected

Shade	Frequency	Percentage %
A1	19	11.3
A2	27	16.8
A3	34	21.3
A3.5	4	2.5
B1	7	4.4
B2	3	1.9
B3	8	5.0
B4	3	1.9
C1	15	9.4
C2	16	10
C3	2	1.3
C4	1	0.6
D2	4	2.5
D3	7	4.4
D4	4	2.5
All metal crown	8	5.0
<b>Total</b>	<b>162</b>	<b>100</b>

**Table 2:** Distribution of group of tooth shades with gender

Shade	Male	Female
A	29(36%)	51(64%)
B	8(38%)	13(62%)
C	13(39%)	20(61%)
D	9(60%)	6(40%)
<b>All metal</b>	<b>2(25%)</b>	<b>6(75%)</b>

the study showed that shades of 'A' group were more chosen for advance restoration among others, totaling about half of all the shades (50.6%). However, vita shade A3 was the most selected of all the shades and the least selected shade was C4 (Table 1). Lighter shades 'A', were more frequently selected for restoration in

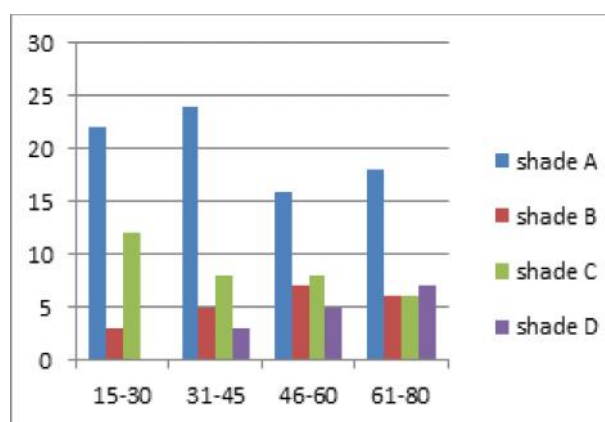


**Fig 1:** Distribution of shade groups

the female patients (64%) while shade 'D' were chosen in the greater percentage of male patients (60%) as compared to the females. (Table 2). Younger age groups less than 45 years old tend to have lighter shade selected for their restorations as shown in Fig. 2.

**Table 3:** Gender distribution of shade selected

Shade	Male	Female
A1	3(15.8%)	16(84.2%)
A2	11(40.7%)	16(59.3%)
A3	13(38.2%)	21(61.8%)
A3.5	2(50%)	2(50%)
B1	3(42.9%)	4(57.1%)
B2	2(66.7%)	1(33.3%)
B3	2(25%)	6(75%)
B4	0(0%)	3(100%)
C1	6(42.9%)	8(57.1%)
C2	6(37.5%)	10(62.5%)
C3	0(0%)	2(100%)
C4	1(100%)	0(0%)
D2	2(50%)	2(50%)
D3	4(50%)	4(50%)
D4	3(75%)	1(25%)
All metal	2(25%)	6(75%)
<b>Total</b>	<b>60</b>	<b>102</b>



**Fig 2:** Distribution of tooth shade groups with age

## DISCUSSION

Shade matching procedure is an important final aspect in aesthetic advance restorations which must be given maximum attention. Knowledge and experience of the clinician play a vital role in matching of correct shade. To avoid wastage of material due to stocking of rarely used shade of porcelain, one needs to know the frequently selected shade and procure the material accordingly. Understanding of the distribution of shades selected for metal ceramic crowns may also be a useful adjunct in tooth shade matching for inexperienced operators.

This study had analyzed the tooth shade selected for aesthetic advanced restorations fabricated over a period of seven years in a tertiary hospital in Nigeria. The analysis found that the most frequently selected shade group was 'A' (orange hue) of which shade A3 was the highest chosen. Smith and Wilson at the University Dental Hospital of Manchester, reported the same shade A3 to be the most frequently chosen in their own study.<sup>10</sup> However, Christina Gomez-Polo *et al.* in their study<sup>14</sup> on Spanish population concluded that the most common hue is M using the 3D master shade guide. The least chosen shade indicated by this present study was vita shade D group which is in line with the study<sup>10</sup> by Smith and Wilson where they reported that the reddish-grey range of hue (D group of vita classical tooth shade guide) were rarely chosen. Lighter shades were chosen in the females compared to their male counterpart as 57% of women had A shade selected for their restoration while only 7% of them had D shade chosen. This is supported by Xiao *et al.*<sup>15</sup> who reported that tooth colour in females was lighter and less yellow compared to that of men. The mean CIEL\* values for females were said to be significantly higher by 1.7 units than for males. Study<sup>16</sup> by Goodkind and Schwabacher also agreed with this as the mean colour value (hue, value and chroma) for males (0.562Y/7.35/2.870) were significantly different from that of females (0.796 Y/7.49/2.81).

Age of patient seems to have impact on the tooth shade selection for their prosthesis. This current study found that younger age group from age 15-45 had lighter shade compared to the older group. This is buttressed by a study<sup>15</sup> by Xiao *et al.* who reported increase in CIEb\* and a reduction in CIEL\* with increasing age. Also, Hasegawa *et al.*<sup>17</sup> found significant positive correlation of CIEb\* and significant negative correlation of CIEL\*. In general these studies including the present study therefore agree that tooth colour darkens with age. This perhaps could be as a result of the nature of the shade dictated by the underlying dentine with increased thickness and also thinning of enamel due to tooth wear with age.<sup>16</sup>

## CONCLUSION

This study showed that Vita shade A3 (3M3) was the most frequently selected shade for aesthetic advanced restoration followed by the A2 (2M2) shade. The least favoured being the shade C4 (5M1). Lighter shades are generally selected more in female patients and younger age group. It is therefore recommended that 'A' shades especially A3 be considered more when purchasing porcelain for advance restoration to stock.

## REFERENCES

1. **Agrawal V**, Kapoor S. Color and Shade Management in Esthetic Dentistry. *Univ Res J Dent.* 2013;3:120–127.
2. **Corcodel N**, Rammelsberg O, Moldovan J, Dreyhaupt A. Effect of external light conditions during matching of tooth color: an intraindividual comparison. *Int J Prosthodont.* 2009;22:75–77.
3. **Seal M**, Talukdar P, Srivastav V, Pendharkar K. Colour matching/: A review of conventional and contemporary dental colour matching systems. *Int J Oral care Res.* 2014;2:47–53.
4. **Freedman G**. Buyer's. Guide to cosmetic imaging systems. *Cosmetic creates pojection of restoration treatment.* *Dent Today.* 2009;7:134–138.
5. **Smitha A**, Savitha P. Shade Matching in Aesthetic Dentistry – From Past to Recent Advances. *J Dent Oral Care Med.* 2017;3:1–9.
6. **Glockner K**, Glockner K, Haiderer B. Visual vs Spectrophotometric Methods for Shade Selection. *Coll. Antropol.* 2015;39:801–802.
7. **Sproull RC**. Color matching in dentistry . Part II. Practical applications of the organization of color. *J Prosthet Dent.* 2001;86:458–464.
8. **Gómez-Polo C**, Gómez-Polo M, Celemin-Viñuela JA. Differences between the human eye and the spectrophotometer in the shade matching of tooth. *J Dent.* 2014;42:742–745.
9. **Villaruel M**, Fahl N, De Sousa A. Direct esthetic restorations based on translucency and opacity of composite resins. *J Esthet Restor Dent.* 2011; 23: 73–87.
10. **Smith PW**, Wilson NH. Shade selection for single-unit anterior metal ceramic crowns/: a 5-year retrospective study of 2,500 cases. *Int J Prosth.* 1998; 11:302–306.
11. **Haralur SB**, Al-Shehri KS, Assiri HM. Influence of personality on tooth shade selection. *Int J Esthet Dent.* 2016;11:126–137.
12. **Pecho OE**, Perez MM, Bona D. Influence of Gender on Visual Shade Matching in. *J Esthet Restor Dent.* 2017;29:E15–23.
13. **Carmen SS**. Basic guide to dental materials. A John Wiley & sons Ltd, publications; 2010. 18-39.
14. **Gómez-polo C**, Gómez-polo M. Study of the most frequent natural tooth colors in the Spanish population using spectrophotometry. *J Adv Prosthodont.* 2015; 7(6):413-422
15. **Xiao J**, Zhou X, Zhu W, *et al.* The prevalence of tooth discolouration and the self- satisfaction with tooth colour in a Chinese urban population. *J Oral Rehabil.* 2007;34:351-360.

16. **Goodkind R**, Schwabacher W. Use of a fiber-optic colorimeter for in vivo colour measurements of 2830 anterior teeth. *J Prosthet Dent.* 1987;58:535–542.
17. **Hasegawa A**, Ikeda I, Kawaguchi S. Color and translucency of in vivo natural central incisors. *J Prosthet Dent.* 2000;83:418–423.