Shade selection of primary maxillary anterior teeth in children using Vitapan classical shade guide

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ABSTRACT

Aim: The purpose of this study was to determine the closest matching shade for primary maxillary anterior teeth from the most widely used Vitapan classical shade guide available for permanent teeth.

Materials and Methods: A total of 313 children aged between 3 and 5 years were evaluated. Using Vitapan classical shade guide was used to determine the shade of six primary maxillary anterior teeth. Scores obtained were noted down in a scoring sheet and values were tabulated. Data collected were tabulated and statistically analyzed using Pearson Chi-square test.

Results: A1 was found to be the closest matching shade for primary maxillary anterior teeth. D3 was found to be the least prevalent shade for primary maxillary anterior teeth. There was no statistical significant difference in the shades among teeth of same quadrant ($p > 0.05$) and also between teeth of right and left quadrants ($p > 0.05$), respectively.

Conclusion: A1 shade of Vitapan classical shade guide is the most prevalent shade for primary maxillary anterior teeth and can be satisfactorily reproduced to all primary maxillary anterior teeth in general.

Key words: Primary maxillary anterior teeth, shade guide, shade matching

Esthetics is of significant importance in anterior teeth restorations and the most challenging factor for a pediatric dentist would be to obtain the parent - child satisfaction. Child patients and their parents desire an esthetically pleasant smile. Shade selection is an important procedure to provide a child with an esthetic restoration that harmoniously blends to the child's existing dentition.

Although color may be unimportant to the physiologic success of a dental restoration, it could be the deciding factor in patient acceptance. Various studies have shown that whenever there was a mismatch of shade with that of natural teeth color in case of resin-bonded strip crowns, parents were not satisfied due to esthetically unacceptable restorations even though the restoration was effective in nature. With improved properties, composite resins have become the material of choice when esthetics in these anterior teeth restorations is of prime consideration.

Shade and color can be described according to the Munsell color space in terms of hue, value, and chroma. Hue distinguishes between different families of color (red, blue, and green). Value indicates the lightness of a color ranging from pure black to pure white. Chroma describes the strength, intensity of vividness of a color. Various dental shade systems are available for the purpose of shade matching which includes the shade pilot, digital camera, and RGB devices – shade scan, spectrophotometry – Vita Easyshade, colorimeter – ShadeVision for dental shade matching. Vita Easyshade is a handheld spectrophotometer for tooth shade

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matching. The instrument consists of a handpiece and a base unit, which are connected with each other by a fiberoptic cable. The fiberoptic tip is approximately 5 mm in diameter and contains 19 optical fibers of 1 mm diameter. While each system has its own advantage, they also have some drawbacks including the standardization, cost, and ease of use in the clinical setup. Interestingly, there is no specific shade guide available for primary teeth other than universal “P” shade from the 3M composites. With this background, the present study was designed with an aim to determine the closest matching shade for primary maxillary anterior teeth from the most widely used Vitapan classical shade guide.

MATERIALS AND METHODS

The present study was conducted after obtaining ethical clearance from the Institutional Review Board and a total of 375 children aged between 3 and 5 years were approached for this study. Children of both the genders with fully erupted, intact anterior teeth with no restorations, malformations, defects, and discolorations were included in the study. Children with traumatic injuries to the upper anterior teeth, white spot lesions, those teeth nearing exfoliation as well as those with poor oral hygiene were excluded from the study. Following preliminary evaluation, a total of 313 children (162 boys and 151 girls) were included in the study after obtaining consent from the parents.

Cheek retractor was placed and any child wearing eyeglass was asked to remove them to avoid any color distraction. Shade names in the shade guide were blinded using a white tape to avoid observer’s bias that could possibly occur during each shade matching trial. 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.

A second examiner conducted the study in a similar way so as to evaluate the interexaminer variability. Each examiner remained unknown regarding the observations of the other throughout the study. Values were recorded by the respective scorer in the pro forma. Data obtained were tabulated and were analyzed using a Chi-square test to evaluate the shade variation among three teeth (central incisor, lateral incisor, canine) of one quadrant (right or left), respectively, and also to evaluate the shade variation between two (right and left) quadrants of one (maxillary) arch. A P < 0.05 was considered to be statistically significant.

Data obtained by both the examiners were also analyzed using Kappa statistics to find out the interexaminer variability and an obtained kappa value of 0.65 showed a good strength of agreement or acceptance between the two examiners.

After 1 week, 35 children among the study population were randomly selected and reexamined by the same (first) observer to find out the intraexaminer reproducibility. Shade selection was carried out for all six primary maxillary anterior teeth using the same methodology. Scores obtained were recorded and statistically analyzed with the previous results of the same set of 35 children. Kappa value obtained was found to be 0.82, thus showing a good strength of agreement or acceptance between two observations by the same examiner.

RESULTS

Shade distribution in six teeth of two quadrants among the study population

Table 1 shows the distribution of all the shades of the Vitapan classical shade guide in maxillary primary anterior teeth among the study population. A1 was found to be the most prevalent shade followed by A2, B1, C1, A3, D2, B2 in descending order and the least prevalent shade was found to be D3 while there is no shade D1 in D group of the Vitapan classical shade guide as given by the manufacturer, the present study results showed that none of the teeth of study population had A3.5, A4, B3, B4, C2, C3, C4, D4 shades present.

Comparison of different shades occurring between two teeth of same quadrant

Table 2 shows the intraquadrant comparison of various shades present in the teeth of both right and left quadrants (maxilla) among the study population. Although there was a slight difference in the prevalence of various shades in teeth, Chi-square test showed that this difference was not statistically significant (P > 0.05).

Comparison of different shades occurring between two similar teeth of right and left quadrants

Table 3 shows the interquadrant comparison of teeth between right and left quadrants. There was no statistically significant difference in the distribution of various shades between central incisors (51 vs. 61), lateral incisors (52 vs. 62), and canines (53 vs. 63) of both the quadrants (P > 0.05).

DISCUSSION

Color is one of the most important determinants of dental esthetics. Tooth color is determined by a combination of extrinsic and intrinsic factors. Extrinsic factors are
Table 1: Shade distribution in six teeth of two quadrants among the study population

| Tooth number | A1 | A2 | A3 | B1 | B2 | C1 | D2 | D3 |
|--------------|----|----|----|----|----|----|----|----|
| 51           | 128| 63 | 19 | 50 | 3  | 39 | 9  | 2  |
| 52           | 118| 58 | 30 | 52 | 3  | 41 | 9  | 2  |
| 53           | 120| 75 | 26 | 44 | 2  | 36 | 8  | 2  |
| 61           | 133| 66 | 14 | 56 | 3  | 30 | 9  | 2  |
| 62           | 130| 73 | 28 | 42 | 3  | 26 | 9  | 2  |
| 63           | 116| 70 | 23 | 48 | 2  | 44 | 8  | 2  |
| Total        | 745| 405| 140| 292| 16 | 216| 52 | 12 |
| n (%)        | 39.67| 21.57| 7.45| 15.55| 0.85| 11.5| 2.77| 0.64|

Table 2: Comparison of different shades occurring between two teeth of same quadrant

| Comparison                        | P (NS) |
|-----------------------------------|--------|
| One quadrant (right)              |        |
| 51 versus 52                      | 0.998  |
| 51 versus 53                      | 0.807  |
| 52 versus 53                      | 0.785  |
| Two quadrant (left)               |        |
| 61 versus 62                      | 0.962  |
| 61 versus 63                      | 0.440  |
| 62 versus 63                      | 0.379  |

Table 3: Comparison of different shades occurring between two similar teeth of right and left quadrants

| Comparison                        | P (NS) |
|-----------------------------------|--------|
| 51 versus 61                      | 0.999  |
| 52 versus 62                      | 0.901  |
| 53 versus 63                      | 0.399  |

related to the deposition of either food or beverage stains over the enamel and the acquired pellicle. Intrinsic factors are related to the enamel and dentin properties of reflection and light dispersion. The choice of the correct tooth shade for the fabrication of a restoration poses a challenge, even for experienced clinicians. Various factors, such as type and intensity of the light source, time of day and year, angle of incidence, and patient’s clothes and color of the operatory furnishings will influence and complicate the shade-taking procedure.

Dental shade guides are widely used as standards to select the color of teeth. They are used for the purpose of shade selection for the conservative esthetic restorations which is probably the most important part of the appointment period and tooth shade matching is the most important clinical step during prosthetic treatment as well. Ideally, shade guides should cover the entire tooth-color range, exhibiting proper distribution, and logical arrangement within this range. In addition, shade tabs should correspond to the restorative material and be constructed in the size, shape, and thickness of layers that correspond to natural teeth. The most popular shade guides available are Vita Classic, Vita System 3D-Master, Chromascope, custom or specific chroma and value guides. Designing and manufacturing dental shade guides are beyond the dental assistant’s control and until the “ideal” color standard appears on the market, practitioners should learn how to use the existing ones in the most efficient manner.

Dental shade guides contain a limited selection of colors compared to those found in human teeth. As there is no specific shade guide available for primary teeth restorations, it is becoming a challenging uphill task to reproduce the correct matching shade even for experienced pediatric clinicians in case of esthetic composite primary anterior teeth restorations in children. The present study was done using a widely used shade guide to find out the shade that most commonly matches all of the primary maxillary anterior teeth among the study population in general.

In this present study, a traditional method of shade matching using a conventional shade guide under daylight was carried out among 313 children aged between 3 and 5 years in Chennai, to find out the most prevalent shade for primary maxillary anterior teeth. In previous studies, shade matching was done using the other dental shade matching systems such as spectrophotometer and spectroscope. As these methods seem to be more expensive and also host some difficulty regarding the standardization and ease of use in the clinical setup, it is necessary for the dentist to depend on one method of shade matching system which is child-friendly, simple, and gives reliable results as well. Vitapan classical shade guide was used for shade matching in this study as it is one of the widely used methods among the dentist population for determining the shade to restore the primary maxillary anterior teeth.

Only maxillary anterior teeth were selected for the study as they are more prone for damage due to trauma, early childhood caries, and often need restorations. Dentoalveolar complex plays a very important role in the appearance of facial esthetics which in turn contribute to the total attractiveness of the face. Even a 2-year-old child is now able to distinguish between attractive and unattractive peers, so facial esthetics is of utmost importance and maxillary teeth play a major role in this facial esthetics as they are seen in the smile line. Furthermore, maxillary teeth will only be seen to a major extent in children with primary dentition as there will be the presence of physiologic deep bite in majority of the children with primary dentition and due to such reasons, mandibular teeth were not included in the study, and also these teeth are considered to be esthetically less significant in case of primary dentition.

The results of the present study showed that A1 (40.15%) was the most prevalent shade among the study population followed by A2 (21.3%) and B1 (21.2%) in descending order. These results are in accordance with the results of the study done by Kim et al. who showed A1 as the most closest...
matching shade for primary teeth in children with 46% and A2 with 25% and B1 with 11%. In another study by Meera et al., spectroscope has been used for shade matching and they showed D2 to be the most close matching shade for anterior primary teeth in children. The reason for the variation in the study results could be due to the different shade matching system used. Our study might be the pioneer in comparing the shades of teeth between the right and left primary maxillary anterior teeth and among the teeth of same quadrant, both of which showed no statistical significant difference.

The present study was an attempt to find the most prevalent shade for primary maxillary anterior teeth among a group of school going children in Chennai, using a shade guide available for permanent teeth. However, the present study did not pertain to consider the hue, value, and chroma factors of color as the shade matching process was done with a traditional and most widely used shade matching system, using a shade guide which most of the clinicians from both urban and rural India use in their clinical practice.

Future studies should aim at targeting a larger study population with assessment of shade variations in age, gender, and different areas (incisal, middle and cervical) of the tooth with the use of spectrophotometer and other newer techniques available such as the Commission Internationale de L’Eclairage (CIE) L × a × b three-dimensional color notation system, that is, frequently used in color research in dentistry proposed by “The CIE” to find out the most common shades for primary dentition which would help the Pediatric Dental Society in formulating an unique shade matching system for children’s teeth. Furthermore, the customization of shade matching process equivalent to the existing shades of the restorative material in clinical practice can be accomplished by utilizing the common and simpler shade matching systems as it helps the pediatric dentists in achieving close reproduction of the restoration to improve esthetics as well as to maintain the mental well-being of the child.

CONCLUSION

Based on the results obtained from the study, it can be concluded that one closest matching shade can be satisfactorily reproduced to all primary maxillary anterior teeth. In this study, A1 shade of Vitapan classical shade guide was the most prevalent shade of primary maxillary anterior teeth in children.

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Conflicts of interest
There are no conflicts of interest.

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