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Dentistry

SHADE SELECTION: AN ART IN DENTISTRY

Dr Abhinav Jain M.D.S Senior Resident

ABSTRACT Shade matching involves a delicate balance between managing realistic goals against personally held expectations. Consistent and correct shade selection is fundamental to the placement of aesthetic restorations which are an essential part of everyday practice.This article reviews various recent technologic advances to provide excellent shade-matching results and esthetics. The procedure of choosing a shade can be performed using visual method or by an instrument. The kind of shade guide, individual ability to choose shades and conditions the choice is made under, all have influence on reliability and accuracy .

KEYWORDS :

I. INTRODUCTION

Esthetics is the primary concern for patients seeking prosthetic treatment. According to Young —it is apparent that beauty, harmony, naturalness, and individuality are major qualities of esthetics [1]. With a beautiful smile, people tend to feel good about themselves.

The dentist should know the language of color and light characteristics to accurately convey the information to the laboratory [2]. Color is defined as subjective perception of the quality of light and colorimetry is a scientific discipline which enables measuring and specifying the color . Shade matching is science and art combined.

Shade Guides

A shade guide is used for accurately determine the shade of a tooth. The introduction of the three- dimensional Munsell Color Order System would be a boon to dentistry and to the color matching of ceramo-metal restorations.

Clark shade guide (Tooth color indicator): A shade guide was developed in porcelain by Clark 60 years ago. There was 60 tabs in the Clark guide. In 60 tabs - 3 basic hue, 19 value, 6 chroma. According to him, Value is the important dimension to control [4].

Spectatone: used 12 hues, but the shade guide had only every other hue represented. The missing hues could be selected by interpolation. Once the closest hue was selected, the viewer had 36 value and chroma variations of this hue. Since there were 6 hues, a total of 256 selection tabs were available, and an additional 256 tabs could be created by interpolation. The system enabled the viewer to move about in the color space to every hue, value, and chroma needed to achieve the closest match to the tooth being replicated. Even though the initial consideration of 256 tabs seemed overwhelming, the guide was simpler and more effective than the illogically ordered systems having fewer tabs [5].

VITA Shade guide (VITAPAN CLASS-I): Introduced in 1956, it is a very popular shade guide : Tabs of similar hue are grouped into letter groups like: A (hue of red-yellow) - A1, A2, A3, A3.5, A4 B (hue of yellow) - B1, B2, B3, B4 C (hue of gray) - C1, C2, C3, C4 D (hue of red-yellow-gray) - D2, D3, D4 Chroma is designated with numerical values 1, 2, 3and 4 .

Classical shade guide introduced by Miller (11) was too low in chroma and too high in value when compared to natural extracted tooth samples. The “value scale” is inaccurate in terms of decreasing L* values, exhibiting redundancy and uneven lightness differences among neighboring tabs, which to a certain extent compromises the results of clinical studies that have been performed so far.

Vita pan 3D-Master Shade Guide: The manufacturer of this recently introduced shade system which covers the entire color space (Figure 2). It was introduced in 1998 and reflects distribution of tooth shades in nature. There is systematic and equidistant coverage of the natural tooth shade spectrum [6, 7].The shade sample are grouped in six lightness levels, each of which has chroma variations in evenly spaced steps. The shade is spaced in steps (ΔE) of CIELAB 4 units in the lightness dimension and 2 CIELAB units in the hue and chroma dimensions [8].

The Vitapan 3D master shade guide, , system reflects systematic and equidistant coverage of the natural tooth shade spectrum. The design features selection of value levels followed by the chroma and determination of hue.

Two types of shade guides are available for shade selection in Vitapan 3D master shade guide –

a. Vitapan 3D master tooth guide (blue chips) – vita 3D master tooth guide features fired porcelain shade samples built up with cervical, dentine, incisal powders as known to you from most conventional shade guide.

b. Vitapan 3D master color guide (red chips) – in contrast to Vitapan 3D master tooth guide porcelain sample contain dentin color without cervical, incisal distinction used to determine basic body color help to see value, chroma, hue in each third that do not match gradations of color in blue chips.

The 3D master is based on the value system rather than grouping the shade by hue as in vita classical and Chromascoplvoclar, Vivodent. The tabs arranged in 5 value level. Within each level tabs present different chroma, hue. Five levels cover that area of the CIELAB color solid occupied by natural teeth, with 50% of natural tooth shades occupying middle value level. The highest value level has 2 chroma steps of single hue [9,10].

Bayindir et al stated that the Vitapan 3D master shade guide system results in lower coverage errors than the Vita lumin or Chromascop shade guide systems. Ahn et al. concluded that the color distribution of the Vitapan 3D master shade guide was more ordered than previously reported color distributions of other, traditional shade guides. . According to the literature, the new Vita Bleached guide 3D master shade guide (Vident), designed primarily for tooth-whitening monitoring, has significant advantages over the Vitapan Classical: the tab arrangement corresponds to visual finding, it includes extra light shades, the color range is almost doubled, the color distribution is more uniform, and the chroa steps are consistent.

Visually optimal shade guide: Analoui., et al. (2004) designed an optimal shade guide with the use of a hierarchical technique [11]. The hierarchical clustering is a mathematical procedure for creating a sequence of partitions with in a data set It was demonstrated that a hierarchical clustering can be used to design an optimal shade guide. without cervical, incisal distinction used to determine basic body color help to see value, chroma, hue in each third that do not match gradations of color in blue chips.

a. Dentin shade guides - When using a translucent all-ceramic system for a crown or veneer communicating the shade of the prepared dentin to the dental laboratory is helpful [12]. The system provides specially colored die materials that match the dentin shade guide and enable the technician to judge restoration esthetics.

b. Custom shade guide - Sometimes, certain teeth may be impossible to match to commercial shade samples. In addition difficulties may be encountered in reproducing the shade guides in the final restorations. One approach to this problem is to extend concept of a commercial shade guide by making custom shade guide [13]. The fabrication of a

custom shade guide, especially one having an expanded shade range can be very helpful. Although fabrication of such a guide is time consuming it provides a more realistic representation of what is achievable

c. Modified shade guide - When a tooth closely approximates a specific shade selection tab, but has characterizations or deviations, those variations may be defined and communicated using a shade guide with the glaze removed and a set of dental surface colorants (—stains□). Airborne particle abrading using aluminum oxide is recommended to remove the glaze although this may also be done using emery discs. The colorant may be applied, and removed or modified until the proper effect is achieved [15,16].

Recent Advances

Advances in electronic technology have provided solutions for many of the current problems in shade selection and color matching in dentistry:

Advantage of Digital shade analysis

a) Eliminates the subjectivity of color analysis and provides exact information for laboratory fabrication of the prosthesis.
b) Influence is more objective, can be repeatedly verified.
c) Not influenced by external factors like surrounding environment
d) Involves less chair-side time.
e) The quality control aspect is a real advantage. The technician can verify that the color replication process was accurate for the shade requested, and. with the more sophisticated systems, a —virtual try-in□ can be accomplished.
f) The reading can be translated to materials that can reproduce those characteristics in the fabricated restorations.

Currently Available Devices

a. Shofu's Shade Chroma Meter
b. The Vita Easyshade
c. The ShadeScan
d . RGB Devices
d. ShadeRite Dental Vision System
e. The Spectro Shade
f. Clear Match System

Shofu's Shade Chroma Meter

This consists of a freestanding, hand-held contact probe which is about 3 mm in diameter. The probe is placed against the tooth, and an activation button is pushed. This sends a Hash of light to the tooth from the periphery of the probe, and the reflected light is transported through the center of the probe to the detector where the collected light is evenly distributed through color filters that closely match the three standard observer functions [16]. Data are transmitted to the docking unit via an infrared signal. There is a database of porcelain samples stored in memory, and the closest match of the target with the stored data is presented. Readout is generated that includes the tooth number; the closest Vita Lumin shade guide designation; and specific opaque, body, and enamel powders.

The Vita Easyshade

It is a hand-held spectrophotometer that consists of a hand piece connected to a base unit by a monocoil fiber optic cable assembly. The contact probe tip is approximately 5 mm in diameter.It contains 19 1-mm- diameter fiber optic bundles. During the measurement process, the tooth is illuminated by the periphery of the tip, directing the light from a halogen bulb in the base unit into the tooth surface. Through this arrangement, spectral reflectance of the scattered light is essentially measured in 25 nm bandwidths.

VITA Easyshade Compact is the device that meets the greatest number of requirements for choosing the shades in clinical settings. The device can be used to determine an overall tooth shade, the shade of each third of the tooth- cervical, middle and incisal, as well as to confirm the shade of the restoration. VITA Easyshade Compact is able to measure a wide range of colors which include VITA Linerguide 3D-Master, VITA Toothguide 3D-Master and VITAPAN A1-D4 classic shades.

The Shade Scan

It is a hand-held device with a color LCD screen to aid in image location and focus. Through a fiber optic cable, a halogen light source illuminates the tooth surface at a 45° angle and collects the reflected light at 0°. Light intensity and calibration to gray and color standards are continuously monitored and adjusted to provide consistent color reproduction.The image is recorded on a flashcard, obviating the need for a computer in the operatory.

RGB Devices

RED, GREEN, BLUE image information to create a color image. They do not control key variables associated with accurate color determination. ShadeScan™ measures shades over the entire tooth surface, then analyzes them and generate a shade match report. It likewise can generate a report to be used with any standard shade guide system. ShadeScan™ creates an image of the tooth with a translucency and characterization map, and then will generate a printed report. Besides using ShadeScan™ for crowns and bridges, the manufacturers suggest using it also for direct restorations and to monitor treatment

Shade Rite Dental Vision System

It is another instrument that combines digital color analysis with colorimetric analysis.It consists of a hand-held device with its own light source, and an LCD screen facilitates positioning on the tooth. To focus and align the camera, a —glare spot□ must be located at the junction of the gingival and middle thirds of the tooth. Measurements are taken through a series of rotating filters that simulate the CIE standard observer functions.

The Spectro Shade

It is the dental shade-taking device most complex in design and is the most cumbersome in terms of hardware. It is the only one that combines digital color imaging with spectrophotometric analysis. It offers the most flexibility in terms of color analysis and colorimetric data and is by far the most expensive. The hand piece is relatively large compared with the contact probe designs.

Clear Match System

This is a software system that requires a Window platform PC and a digital camera. To properly calibrate the digital color signal, a black and white standard and a shade tab must be included in each photograph.. Use your digital camera to take the pictures. Take three pictures as one picture will usually be better than the other two. Also, take pictures prior to prep so the teeth are hydrated. Email the pictures to your lab or import the pictures into the software.

DIGITAL CAMERAS

Digital cameras are efficient and easy to use and can be an ideal supplement for the clinician and lab technician in quantifying shade but alone not a very reliable method for shade analysis (14). Factors such as illumination and the angle of the photograph will alter how color is perceived by the camera. Alvin et al. (15) stated the use of Commercial SLR cameras when combined with the appropriate calibration protocols showed potential for use in the color replication process. Spear stated the use of color-corrected professional quality film (e.g. Kodak EPN-100, E100-S, or EPP) and has a good photo lab to develop them, taking vector shots at 65-70° looking down with an incisal edge away from chroma and hue helps in increasing the amount of reflection (16).

STump ShAde SeleCTIon

It is important to communicate the prepared tooth or "stump" shade to the ceramist so that they can build the restoration with the right opacity/ translucency (20). It may be necessary to use a more opaque ceramic to block out discoloration, e.g. an alumina- or zirconia based restoration may be a better choice than a glass-based ceramic.

ColoRImeTeRS

They provide measurements in CIELAB units (L*, A*, B*) that can compare the color parameters of dif- ferent objects when analyzed math- ematically. Colorimeters can be of two types mainly the photoelectric tristimulus colorimeters (Microcolor) and silicon photodiode array (Orient Scientific Ltd). Microcolor colorimeter (a photoelectric tri-stimulus color- imeter) is a self-contained measuring system that requires no external power source while a silicon photodiode ar- ray requires both an external power source and a standard light source; it is a compact color measuring instru- ment that is less prone to overheating and is cost effective (19). Available colorimeters are X-Rite Shade Vision.

I. CONCLUSION

Attractive smile is a necessary part of a confident presentation of the mselves. It is a challenge for every esthetic dentist to determine and replicate the appearance of teeth, as it requires humility, patience and

perseverance to mimic nature to its closest sense and form. Dental art does not occur automatically. It must be purposely and carefully incorporated into the treatment plan by the dentist. Understanding the influence of different variables in shade selection from light illumination to the tooth's hue, value and chroma and how the eye interprets this can assist in this selection. The use of the Vita System 3D-Master allows a logical selection of color into hue, value and chroma . There are limitations of shade guides as they fail to account for the variability found in natural teeth, e.g. fluorescence, opalescence, translucency, enamel thickness, and objectivity. Effects of surface texture on light reflection and different characterizations must be recorded and duplicated in the final restorations. The use of technology with different devices in shade selection may eliminate subjectivity of choosing and the use of photography to communicate shades and characterizations has improved the selection process. A procedure of shade selection has been described to ensure consistent results considering the different variables that influence shade matching.

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