Oral Health Case Reports
ISSN: 2471-8726
Chou and Elathamna, Oral health case Rep 2016, 2:1
DOI; 10.4172/2471-8726.1000106
Case Report Open Access

Shade Analysis by Digitally Flipping Shade Tabs

Jang-Ching Chou* and Eiad Elathamna
Department of Oral Health and Rehabilitation, University of Louisville, School of Dentistry, USA

Abstract

A technique for clinical shade analysis is presented. The technique involves first eliminating shade tabs with dissimilar shades, and then taking digital images of the target tooth with a shade tab aligned edge-to-edge. The image of the shade tab is then digitally duplicated, cropped, and flipped. The cropped and flipped shade tab is aligned adjacent to the target tooth to visualize the color gradient.

Introduction

Accurate shade matching and communication with the dental laboratory is important in providing patients with esthetically pleasing restorations. Currently, color assessment methods include: visual assessment with shade guides, spectrophotometry, colorimetry, and computer analysis of digital images [1]. There has been a considerable amount of research aimed at making visual assessment more accurate, such as determining value prior to chroma and hue, and varying the arrangement of shade tabs [2-4]. However, studies have found lower levels of accuracy for visual shade matching when compared with instrument-based methods [5-8]. Even among instrument-based methods, there is considerable variation in accuracy between different systems [9-12] Moreover; it is difficult to assess the color gradient of the tooth with popular spectrophotometers, because of the size of the probe diameter [6].

Recently, computer analysis of digital images has been studied as a method for color assessment [13-16]. One method is to take a digital photograph with all 26 shade tabs in the same image, and digitally assessing color using computer software [13]. Another method is to prepare a "digital shade guide", by taking individual images of shade tabs, and cropping the digital shade tab images [14]. These images are then overlayed onto the digital image of the target tooth for computer analysis [14]. However, these techniques may be limited in accuracy due to the inconsistency in lighting of commercially available flashes [16].

Another advancement that has gained popularity is the utilization of Feld spathic porcelains with multiple shades [17]. With the myriad of porcelain shades to choose from, it has become increasingly important to perform color mapping of teeth [17]. Simple methods of color mapping include dividing the tooth into gingival, middle, and incisal thirds [18,19]. Advanced methods of color mapping detail the location of specific porcelains to mimic intrinsic and extrinsic characterizations of teeth [20]. These detailed color maps require considerable experience, and are not easily created with most instrumental methods [6,14]. This manuscript describes a technique for clinical shade matching and analysis, using digital photography and computer software.

Technique

• Wet the teeth and the shade tabs, retract lips using lip retractors.

• Using a process of elimination, eliminate shade tabs that are clearly dissimilar to the target tooth. Three to five shade tabs should remain.

• Place one shade tab close to the tooth to be matched, so that the incisal edges are directed toward each other. There should be approximately 1mm of space between the incisal edges of the tooth and the shade tab.

• Take a digital image of the tooth along with the shade tab, making sure that the long axis of the tooth and the shade tab are directed perpendicular to the horizontal plane of the image taken. The shade number should be clearly visible (Figure 1).

• After taking the image, check to make sure it is not overexposed or underexposed. Compensate for overexposure or underexposure by either adjusting the flash lighting, shutter speed, aperture size (F-Stop), and/or ISO.

• The reflection from the flash should be near the middle to cervical third of the target tooth and the shade tab.

• Repeat for all remaining shade tabs

• Download all of the images to a personal computer

• Using image editing or presentation software (Photoshop CS5, Adobe), duplicate one side of the shade tab on the image.

• Rotate the duplicate image, and place over the target tooth. Resize the cropped duplicate image to align the incisal edges and gingival margins (Figure 2).

• Repeat for all remaining shade tabs

• Print out the images in a high quality color printer and send to

Figure 1: Take the digital photograph with the shade tab pointed toward the tooth, 1 mm apart.

***Corresponding author:** Dr. Jang-Ching Chou DDS, MS Department of Oral Health and Rehabilitation, Room 310 University of Louisville, School of Dentistry, 501 South Preston Street, Louisville KY 40292, USA, Fax: (502) 852-1317; E-mail: jangching.chou@louisville.edu

Received: January 22, 2016; **Accepted:** January 28, 2016; **Published**: February 08, 2016

Citation: Chou J, Elathamna E (2016) Shade Analysis by Digitally Flipping Shade Tabs. Oral health case Rep 1:106. doi:10.4172/2471-8726.1000106

Figure 2: Shade tab digitally duplicated, cropped, flipped, and positioned adjacent to target tooth.

Figure 3: Assess form, texture, color, and characterization. The maxillary left canine is a porcelain-fused-to-metal screw-retained implant restoration.

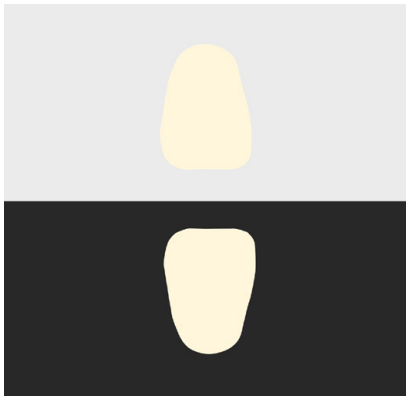

Figure 4: Effect of simultaneous contrast; note that although the teeth are the same color, the lower one appears to be lighter.

laboratory along with the articulated casts. Use the printed images to communicate shade information with the dental laboratory. Alternatively, send the digital images or presentation file to the dental laboratory electronically.

• Inspect the definitive restoration before delivery. Assess form, texture, color, and characterization (Figure 3).

Discussion

The principle of simultaneous contrast dictates that different colors placed side by side effects the perception of the intensity of the color [21]. When one color is surrounded by a darker color, it appears to be lighter, and when it is surrounded by a lighter color, it appears to be darker (Figure 4). This phenomenon is explained by theories such as lateral inhibition of neurons and the principle of belongingness [22]. The target tooth is surrounded by the lightness of adjacent teeth, whereas the shade tab is surrounded by the darkness of the oral cavity, which makes inconsistencies from simultaneous contrast more likely. In addition, because the distance between the cervical portion of the tooth and the shade tab is greater than that of the incisal edges, the cervical shade may be the most difficult to match. The present technique eliminates this difference by placing the shade tab directly adjacent to the target tooth.

Schropp [13] described a technique in which all 26 shade tabs and the target tooth are in the same image. In the present technique, only one shade tab is used at a time, which allows the shade tab and the target tooth to be in the same orientation and distance relative to the camera flashes. This may prevent differences in amount of light directed toward the target tooth and shade tab. The edge-to-edge orientation also prevents shadows from falling on the target tooth [17].

The major disadvantage of this technique stems from possible inaccuracies in variations in light output from camera flashes [16]. These variations include variations in light intensity during separate flash firings, and inconsistencies in the spectrum of light [16]. Jarad et al., [14] advocated a technique which combines previously taken images of shade tabs with an image of the target tooth. A perfect match rate of 61% was found using that technique [14]. The present technique may prevent such inaccuracies by keeping the image of the shade tab and the target tooth in the same image. However, inconsistencies in light intensity may still prevent finding the closest matching color. These inaccuracies may be minimized by checking the batteries of the camera flash; adjusting the white balance, aperture, shutter, and ISO settings of the camera; using an LED light source; and/or using a dual polarized system [16].

Summary

A technique for shade matching and analysis was described. Non-matching shade tabs are first eliminated. A digital image of the target tooth and one of the remaining tabs is taken, with the shade tab positioned edge to edge toward the target tooth. Multiple digital images are taken. The shade tabs are digitally duplicated, cropped, flipped, and positioned adjacent to the target tooth to facilitate visualization of color, texture, and characterization by the clinician and dental laboratory technician.

References

1. Joiner A (2004) Tooth colour: a review of the literature. J Prosthet Dent 1: 3-12.
2. Hall NR (1991) Tooth colour selection: the application of colour science to dental colour matching. Aust Prosthet J 5: 41-6.
3. Preston JD (1985) Current status of shade selection and color matching. Quintessence Int 16: 47-58.
4. Corcodel N, Rammelsberg P, Jakstat H, Moldovan O, Schwarz S, et al. (2010) The linear shade guide design of Vita 3D-master performs as well as the original design of the Vita 3D-master. J Oral Rehabil 37: 860-5
5. Okubo SR, Kanawati A, Richards MW, Childress S (1998) Evaluation of visual and instrument shade matching. J Prosthet Dent 80: 642-8.
6. Alsaleh S, Labban M, AlHariri M, Tashkandi E (2012) Evaluation of self-shade matching ability of dental students using visual and instrumental means. J Dent 40(1): 82-7.
7. Kielbassa AM, Beheim-Schwarzbach NJ, Neumann K, Nat R, Zantner C, et al. (2009) In vitro comparison of visual and computer-aided pre- and post-tooth shade determination using various home bleaching procedures. J Prosthet Dent 101: 92-100.
8. Della Bona A, Barrett AA, Rosa V, Pinzetta C (2009) Visual and instrumental agreement in dental shade selection: three distinct observer populations and shade matching protocols. Dent Mater 25: 276-81.
9. Kristiansen J, Sakai M, Da Silva JD, Gil M, Ishikawa-Nagai S, et al. (2011) Assessment of a prototype computer colour matching system to reproduce natural tooth colour on ceramic restorations. J Dent 3: 45-51.

10. Johnston WM (2009) Color measurement in dentistry. J Dent 37(1): 2-6.

11. Douglas RD, Steinhauer TJ, Wee AG (2007) Intraoral determination of the tolerance of dentists for perceptibility and acceptability of shade mismatch. J Prosthet Dent 97: 200-8.

12. Lagouvardos PE, Fougia AG, Diamantopoulou SA, Polyzois GL (2009) Repeatability and inter device reliability of two portable color selection devices in matching and measuring tooth color. J Prosthet Dent 101: 40-5.

13. Schropp L (2009) Shade matching assisted by digital photography and computer software. J Prosthodont 18: 235-41.

14. Jarad FD, Russell MD, Moss BW (2005) The use of digital imaging for colour matching and communication in restorative dentistry. Br Dent J 199: 43-9.

15. Wee AG, Lindsey DT, Kuo S, Johnston WM (2006) Color accuracy of commercial digital Cameras for use in dentistry. Dent Mater 22: 553-9.

16. Tung OH, Lai YL, Ho YC, Chou IC, Lee SY, et al. (2011) Development of digital shade guides for color assessment using a digital camera with ring flashes. Clin Oral Investig 15: 49-56.

17. Chu SJ (2007) Clinical steps to predictable color management in aesthetic restorative dentistry. Dent Clin North Am 51: 473-85

18. Marcucci B (2003) A shade selection technique. J Prosthet Dent 89: 518-21.

19. Rosenstiel SF, Land MF, Fujimoto J (2006) Contemporary fixed prosthodontics, (4thedn), St. Louis: Elsevier; 724.

20. Chiche GJ, Pinault A (1995) Esthetics of Anterior Fixed Prosthodontics. Chicago: Quintessence Publishing; p. 138-40.

21. Chevreul ME (1854) The Principles of Harmony and Contrast of Colours, and Their Applications to the Arts. A. and G. A. Spottiswoode Publishers, London, UK.

22. Goldstein EB (2013) Sensation and Perception, (9thedn), Wadsworth 58-60.