Dental COLLABORATIONS A Winter 2005

Photographic Documentation
of Shade Information for the Laboratory

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During shade matching, clinical photographs that are properly exposed document details that may be overlooked by the naked eye. By specifically manipulating the background, exposure angle of camera to the teeth, and the camera lens depth of field (aperture), the practitioner can magnify the value of the information portrayed in the images. The essential parameters of an optimal shade match can be documented with three groups of images strategically composed to highlight the different shade dimensions. These are presented in the following discussion.

GROUP 1—SHAPE AND SURFACE MORPHOLOGY DOCUMENTATION (FIGURE 1)

For the evaluation of surface morphology (texture and luster), surface flash reflections are maximized by using a dual-point or circumferential flash, and the image is flooded with light. Recommended protocol:

- **Black background is preferred, but not mandatory;**
- **The tooth surface is dried and cleaned; and**
- **The camera lens should be oriented perpendicular to the surface being evaluated.**

Note that lens aperture is not essential in this group.

GROUP 2—TRANSLUCENCY DOCUMENTATION (FIGURE 2)

Translucency by definition is the gradient between transparent and opaque. The amount of translucency as well as the thickness of the enamel layer is important for a successful match. Translucent enamel has the property of opalescence[1-3] which can be mapped photographically. Opalescence can best be seen in lower light conditions and also by using dark backgrounds.[4,5]

Recommended protocol:

- **Teeth are cleaned;**
- **A black background is preferred;**
- **Lens is angled >30° from perpendicular to limit reflections;**
- **Advanced photographers should set flash on manual and slightly underexpose by incrementally closing down the F stop to create more visual depth and easier discernment of the layers of the target tooth. It also enhances visualization of the tooth by further lessening surface reflections; and**
- **For beginning photographers who prefer through-the-lens (TTL) flash, exposure compensation may be used for slight underexposure.**

GROUP 3—CHROMA AND HUE DOCUMENTATION (FIGURE 3)

Chroma—the saturation of hue—is roughly inversely proportional to value. Reflections from the teeth and tabs slightly underexpose the images and should be limited. An achromatic background should be used, and the red gingiva cropped to limit afterimages.[6]

Recommended protocol:

- **The tooth surface is cleaned, however, saliva may remain on the surface. Water tends to flatten surfaces and lessens reflections caused by surface textures;**
- **Three shade tabs are utilized and arranged incisal edge to incisal edge. Tabs should be parallel and equidistant to the teeth from the lens. The center tab is considered an ideal match with other tabs up or down one chroma stop;**

- Note that an 18% reflective gray card background will limit glare;[7]
- Images should be taken >30° from perpendicular to limit reflections; and
- Note that evaluation of chroma and hue is facilitated with slight underexposure as described in group 2.

DISCUSSION

The visual appearance of any object is determined by the quantity and quality of the light emanating from the object. This light may result from reflection or from transillumination; in the dental context, it is primarily from reflection. Competent prosthodontic replacement, therefore, requires duplication of how light is reflected from the tooth. Hence, the clinician must document and communicate how the majority of this light is reflected to the laboratory to ensure optimal definitive results. The characteristics that affect the quantity and quality of the reflected light in order of their importance are: shape or silhouette, surface morphology, value, translucency, chroma, and hue[6].

Surface reflections render the surface opaque and are the same hue as the flash[8]. The amount of surface reflections in the photographs is determined by how close to perpendicular the flash is to the tooth surface. When documenting translucency or hue, reflections are minimized by angling the camera greater than 30° from perpendicular. When assessing surface texture, it is important to maximize surface reflections.

Achromatic gray and black backgrounds serve to limit the distractions and color influences of the oral environment and to help visualize internal tooth characteristics. Gray backgrounds are restful to the cones of the eye and also improve ability to render hue without afterimages[9]; these backgrounds also produce less glare than black. In addition, an extremely bright object against a dark background will interfere with perception[5], reducing the ability to perceive visual information. This interference is generically called glare. In dental photography, the use of a black

FIGURE 1. Shape may be documented with or without a background, however, a black background provides fewer distractions and better contrast.

FIGURE 2. The amount of translucency and thickness of the enamel layer is vital for a successful shade match.

FIGURE 3. Three shade tabs arranged incisal edge to incisal edge should be parallel and equidistant to the teeth from the lens.

background increases impact, however, it also causes glare, thus masking shade mismatches.

The dentition is frequently overexposed using TTL photography. Due to the dark background, the light meter increases the aperture size or slows the shutter speed, allowing the entrance of additional light. Since the teeth are the brightest objects in the image, they appear "washed out." Closing down the aperture decreases the surface brightness, enabling better visualization into the tooth. The opalescent blues are more visible with slight underexposure. Underexposure and using a black background will significantly increase the ability to observe the translucent enamel layer. The goal in fabricating a porcelain restoration is to stack porcelain in layers with the same thickness and optical characteristics as the tooth. The contrived translucency photographs of group 2 artificially increase the visibility of the opalescent enamel and should be used only for assessing the thickness and opacity of the enamel.

CONCLUSION

By specifically manipulating the background, exposure angle of camera to the teeth, and the camera lens depth of field (aperture), the practitioner can magnify the value of the information portrayed in the images. This "added value" enables the laboratory to more accurately fabricate the restorations, thus ensuring an optimal shade match and ultimately enhancing the final results. ■

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CONTINUING EDUCATION EXERCISE

CONTINUING EDUCATION

The 10 multiple-choice questions for this Continuing Education (CE) exercise are based on the article "Photographic Documentation of Shade Information for the Laboratory" by James Fondriest, DDS.

Upon reading this article and completing this exercise, the reader should:

- **Learn how to enhance the value of the information obtained from clinical photographs.**
- **Become familiar with the parameters necessary to achieve ideal shade match for provisional and definitive restorations.**

1. Translucency can be defined as:
a. Texture and luster.
b. Gradient between transparent and opaque.
c. Camera depth.
d. Image exposure.

2. Chroma is described as:
a. The saturation of translucency and is roughly inversely proportional to value.
b. The saturation of hue and is roughly inversely proportional to value.
c. The elimination of surface reflections.
d. None of the above.

3. The camera lens should be _____ to the surface being evaluated.
a. Perpendicular.
b. Parallel.
c. Tilted.
d. At a significant distance.

4. Opalescence is best observed:
a. In higher light conditions and with dark backgrounds.
b. In lower light conditions and with light backgrounds.
c. In lower light conditions and with dark backgrounds.
d. With flash reflections.

5. The visual appearance of any object is determined by:
a. Quantity and quality of the light emanating from it.
b. Quantity only.
c. Quality only.
d. None of the above.

6. Several characteristics affect the quality and quantity of reflected light except:
a. Hue.
b. Chroma.
c. Value.
d. Glare.

7. To avoid "washing out" of the teeth, it is recommended that:
a. The surface brightness be eliminated.
b. The aperture be open to decrease surface brightness.
c. The aperture be closed to decrease surface brightness.
d. The surface morphology be modified.

8. Which of the following does not affect the value of the information on the image?
a. Manipulation of the background.
b. Manipulation of the exposure angle of the camera to the tooth.
c. Manipulation of the camera lens depth of field.
d. Manipulation of the surface morphology.

9. Gray backgrounds produce less glare than black backgrounds.
a. True.
b. False.

10. An extremely bright object against a dark background reduces the ability to perceive visual information. This is known as:
a. Glare.
b. Translucency.
c. Chroma.
d. Saturation.