Dental Photography Part II
Protocol for shade taking and communication with the lab

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Abstract
Part I of this article discussed the basic equipment that is necessary for dental photography. In addition, a few examples of pictures taken that were better than others for the same situation were also shown. In part II, a protocol of taking digital photographs will be presented which has been of great help to the author, specifically in achieving the right shade and value.

It is based on standardized pictures that should be taken in order to show certain individual characteristics of the patient to be treated and standardized comparisons of the shade tabs and the natural tooth structures in order to give the technician more information than the usual Az or Ai written on a piece of paper.

Shade taking
The evolution in digital photography and the possibility of taking pictures and evaluating them immediately as well as almost instantaneous access of the information by someone located off-site in the same city or even another country, we have a great resource available that can help us achieve the right shade of our indirect restorations. Standardized high-quality photographs are also an advantage when the shade is taken for a direct restoration - for example a direct veneer or a class IV.

In this case a picture can really help the clinician identify the opalescent areas and the halo effect of the adjacent tooth before re-doing the restoration (Figure 1).

Dental shade taking at the dental lab or in the dental practice can be frustrating as most dentists do not really know how to use the shade guide when they finish their undergraduate studies. In particular, if work has to be redone, because the clinician does not know what was done incorrectly or how to obtain the right shade.

Dental shade guides are used by dentists, dental assistants and dental laboratory technicians to communicate proper tooth color, translucency and brightness.

However, many variables come into play no matter what system you decide to use. Before even starting to think about shade taking, you need to answer an extremely simple and obvious question: are you using ex-actly the same shade system at the lab? There are many shade taking systems available, with variations in the shades between different manufacturers, even though the concept may be the same.

They are also manufactured from different materials with different optical properties. For example, some labs are familiar with the Chromoscope system, most of the dentists with the A-D shade guide, while the younger generation of dentists learned with the VITA master shade guide. (Figure 2) The role of a shade guide is to help standardize the perception and so facilitate the communication in order to match the shade of the natural teeth with the required restoration.

Shade guides are not a perfect representation of what is actually seen but are close enough to identify a range of tooth colors. They are still the best tool for identifying and communicating the correct dental shade. Tooth color can be referred to as being an A2 or A3, between a B2 and B4, and By when describing the respective tooth closest to the one being restored. It is always best to get the patient to the dental lab and have a custom shade taken, if possible, particularly for the more difficult cases. However, in most of the cases this is not possible, due to unwillingness of the patient to spend time going to the lab, or the location of the lab not being in close proximity.

The use of shade guides should be used in conjunction with digital photography if no direct light is projected to the mouth and the shade tabs, the main light source will be the flash of the camera, which has always the same temperature (between 5500° and 6000° K) and can be used by the dentist in the clinic and the technician in the lab. When pictures are taken under different light conditions, the variation between the same shade can be considerable. A good photo for both the dentist and the lab technician can be emailed so that they are both looking at the tooth color under the same conditions. When the technician compares the color of the restoration with the shade guide, he can take a picture that will create an image to be used as a comparison under the same light conditions as the natural tooth in the impression by the clinician (Figures 3-5).

Due to the flash of the camera, the technician can then compare, under the same light conditions as the clinician, whether the restorations look similar to the original shade tab sent by the clinician. (Figure 6, Veneers by CDT Juergen Leier, Liechtenstein)

Tooth Color Basics
Color has two basic characteristics. Hue and Chroma. Natural tooth color also displays these same characteristics. Hue can be defined as the actual color such as, yellow or gray. Chroma is the intensity of that color and is sometimes called saturation. Hue and Chroma are typically represented by a shade guide in terms which color comes closest to the actual tooth being measured. For example, shade guides will have a range of A1 to A6 or B1 to B6. (Figure 7)

Value is the brightness of a tooth. It is therefore given a separate classification than color when communicating shade. Teeth also exhibit translucency and can be measured by how much light can pass through different sections of a tooth. Shade taking problems arise because most natural teeth are not an exact match to a shade guide, nor do shade guides adjust equally express tooth translucency.
and value. In many cases, when it decided that a tooth has a certain shade, the hue and the chroma are communicated to the lab, but never the value and this is where the problems arise.

Very few crowns are accepted if the value is incorrect, while moderate inaccuracies in chroma and hue may go unnoticed. For this reason the shade taking protocol needs to be based on this information being communicated to the lab in the most accurate way possible.

Before the shade is taken conventionally or a picture is taken for the same purpose, several factors need to be controlled:

1. If patient is wearing bright colored clothing, drape him or her with a neutral colored cover.
2. Have patient remove lipstick and other mouthwash, as well as eyewear.
3. Teeth must have been cleaned.
4. The shade taking should be done at the beginning of the appointment, so that teeth are moist (the patient must lick their teeth constantly to keep them moist) and your eyes finish.

5. The operator light should be turned off or pointed in another direction. It must not focus on the patient.
6. The room light conditions should have a temperature of 5500-6500° K (when pictures are taken, these parameters are no longer relevant, because the light of the flash will prevail).

7. Obtain value levels by squinting.
8. Women are far less likely to be color blind than men, so it is a good idea to have your assistant assist in shade taking decisions (assuming that the assistant is a woman and not color blind).

In Part I of this article, the necessary equipment and accessories for adequate intraoral pictures was discussed. Please refer to it for the necessary information if you are planning to purchase adequate equipment. Once the patient is ready, place the shade tabs in front of the anterior teeth, before starting the treatment itself. The same applies for pictures with lips. It is important to repeat the same protocol intraorally, as well as extraorally, because of the large influence of the reds in shade taking (Figures 7-8).

In addition to the points presented before, the following should be considered initially when photographs are taken (Figures 9-15):

1. Avoid the large reflection areas of the metal parts of the shade guide as they reduce the detail of the pictures.
2. Take pictures using two different shade tabs.
3. The surface of the shade tab must be at exactly the same level of the buccal surface of the teeth, as even minor discrepancies can make a tooth look darker or brighter due to the power of the flash.
4. The incisal edge of the tabs should be at roughly the same distance from the natural teeth, or as close as possible, without touching each other.
5. Take pictures with and without contrasters. This is especially relevant in young teeth with opalescent areas and clear halo effects.
6. In cases where an all-ceramic restoration is planned, the shade of the stump should also be given to the lab, using a special shade guide, such as the natural die material shade guide of the IPS e.max system (Ivoclar Vivadent, Liechtenstein).

7. Consider taking some pictures in black and white. A black and white photograph will help show the value of the shade tab in relation to the patient’s tooth (Figure 14).

Clinical case
A 27-year-old female patient came to our office unsatisfied with the appearance of her 2 anterior pfm crowns (Figure 25). The value of both crowns clearly did not match the other teeth and her smile line unfortunately also showed the discolored cervical part of tooth 11 (Figure 26). An overview picture of the stump shade was taken with a reference (Figure 27a). This reference should ideally be the natural die material shade guide of the IPS e.max system (Figure 27b). Both shade guides, the natural die material guide and the A-D shade guide have some similarities, for example, as a rule of thumb an ND2 looks quite similar to an A2 (Figure 27e). Obviously, the natural die material shade guide has shades that are dark, since its purpose is to correlate to artificially discolored stumps and not to recreate natural shades as the A-D shade guide (Figures 27c and 27d).

Internal bleaching of the stump was then performed with 3% hydrogen peroxide (Figure 28) in 2 sessions of 20 minutes each. Figure 29 shows the final result after the composite build-up with Exxite DSC and Multi-Core flow (Ivoclar Vivadent, Liechtenstein). An impressions was taken and sent to the lab.

The cast was scanned and an IPS e.max CAD LT block was milled (Figure 20). The appearance of the crowns is always checked with the natural die material stumps in order to get the correct value and chroma (Figures 21 and 22). Finally, contacts and final integration of the crowns were checked in the solid cast (Figure 23, laboratory work done by CDT Volker Brens, Germany). A retraction cord was placed prior to bonding the crowns (Figure 24). The stumps are etched with phosphoric acid (Figure 25) and Exxite DSC was applied (Figure 26). Variolink N (base and catalyst, translucent shade) were mixed and applied to the crowns (Figure 27). After 4 weeks a natural integration of the crowns with the right hue, value, chroma and effects can be seen in Figure 29.

Acknowledgements

The author would like to thank CDT Jürgen Seger and Volker Brens for their valuable technical work presented in this article.