Conclusion
Given the enamel-like properties of the glass-ceramic material, the mini-

cally invasive methods used for this case provide a long-lasting approach to restoring the function, esthetics and biomechanics of the dentition while minimizing the damage to the biological structures (Figs 8a to 1) [4, 6]. Beneficial clinical long-term results have been described and con-

formed in several studies [4, 8]. Para-

afurnitures, endodontically treated teeth and an adequate amount of enamel have, among others, been flagged as risk factors influencing the success of these restorations [3, 2]. Against such a background, the additive wax-up technique used here proved to be beneficial. Together with a diagnostic matrix, this technique enables a conserva-

tive approach to tooth preparation and helps preserve the remaining enamel during preparation. In ad-

dition, an in vitro investigation has shown encouraging data regarding the stress distribution in ceramic restorations [20]. It is, therefore, important to note that preparations should have soft and rounded tran-

sections to prevent stress peaks from occurring [3]. In recent years, the au-

thors of this report have mainly used glass-ceramic onlays based on lithium disilicate in conjunction with the staining technique [5, 7]. Given its increased strength, this material allows the minimum thickness to be reduced by one third to just over one millimetre, further increasing the amount of tooth structure that can be preserved during preparation.

Given their extremely high strength and optimal marginal integrity, glass-ceramic onlays appear to be ideally suited for restoring the function, esthetics and biomechanical properties of abraded and eroded posterior teeth. They offer an op-

portunity to circumvent traditional prosthetic measures that are more invasive and involve higher biologi-

cal costs [6].

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

By Dr. Eduardo Mahn, Chile

Abstract
Part I of this article discussed the ba-

sic 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 photo-

graphs will be presented which has been of great help to the author, spe-
cifically 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 stand-

ardized comparisons of the shade tabs and the natural tooth structures in order to give the technician more information than the usual A2 or A3 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 indi-

vidual restorations. Standardized high-

quality photographs are also an ad-

vantage 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 adja-

cent tooth, before re-doing the resto-

ration (Figure 1).

Dental shade taking at the dental lab or in the dental practice can be frustrat-

ing as most dentists do not really know how to use the shade guide when they finish their undergradu-

ate studies. In particular, if work has to be redone, because the dentist does not know what was done incor-

rectly wrong or how to obtain the right shade.

Dental shade guides are used by den-


tists, dental assistants and dental lab-

oratory technicians to communicate

proper tooth color, translucency, and brightness. However, many variables come into play no matter what system you de-


cide 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 manu-

facturers, 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 ChromaScope system, most of the dentists with the A-D shade guide, while the younger generation of dentists learned with the JAM 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 rep-

resentation 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 A or B, or between a B2 and B4 when describing the respec-

tive 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, par-


ticularly 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 pro-

jected 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 variations be-

tween the same shades can be con-

sidered. A good photo for both the dentist and the lab technician can be emailed so that they are both look-


ing 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 teeth in the impression by the clini-


cian (Figures 3 - 5).

Due to the flash of the camera, the technician can then compare, under the same light conditions as the cli-


nician, whether the restorations look similar to the original shade tab sent by the clinician. (Figure 6, Veneers by CIT Juergen Seger, Liechtenstein)

Tooth Color Basics

Color has two basic characteristics. Hue and Chroma. Natural tooth color also displays these same charac-


teristics 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 rep-

resented by a shade guide in terms of which color comes closest to the actual tooth being measured. For example, shade guides will have a range of A1 to A4 or B1 to B4, plus C and D shades (Fig 1). Value is the brightness of a tooth. It is therefore given a separate classifica-


tion than color when communicat-


ing shade. Teeth also exhibit translu-

cency and can be measured by how much light can pass through differ-

ent 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 ad-

equately express tooth translucency.
and value. In many cases, when it decided that a tooth has a certain shade, the VITA and the Chroma are communicated to the lab, but never the value and this is where the problem 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, dye him or her with a neutral colored cover.
2. Have patient remove lipstick and other make-up, 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’s 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 15000-65000 K. (When parameters 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. Contrastingly, 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 extrorally, 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 9-10):
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 as 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 mid-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 opaque translucent areas and clear halos 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 (VitraVivident, Liechtenstein).

The operator’s light should be turned off or pointed in another direction. It must not focus on 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 5). 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 21 (Figure 6).

An overview picture of the stump shade was taken with a reference (Figure 7a). This reference should ideally be the natural die material A-D shade guide (Figure 7b). 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 7b). 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 7c and 7d).

Internal bleaching of the stump was then performed with 35% hydrogen peroxide (Figure 8) in 2 sessions of 20 minutes each. Figure 9 shows the final result after the composite build-up with Excite DIC and Multi- core flow (VitraVivident, Liechtenstein). An impression was taken and sent to the lab.

The cast was scanned and an IPS e.max CAD LT block was milled (Figure 10). 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 integrations of the crowns were checked in the solid cast (Figure 23, laboratory work done by CDT Volker Brosch, Germany). A retraction cord was placed prior to bonding the crowns (Figure 24). The stumps are etched with phosphoric acid (Figure 25) and Excite DIC 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.

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)

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