CASE REPORT

See, recognize, realize: visual shade analysis and its realization into a ceramic crown

Bastian Wagner[1]

The wide variety of ceramic materials available today, allows the dental technician to reproduce the natural, dynamic light qualities present in natural dentition. Recognizing and realizing these visual characteristics, however, is a challenge which can only be mastered with a great deal of patience and knowledge.

Each individual patient case requires the full attention of all involved – patient, dentist, dental technician – to the finer details in this complex piece of work. It is the dental technician's job to produce a durable prosthetic restoration, which with its functional, biological and esthetic characteristics, is adapted to suit the individual requirements and specifications of the patient.

The advancement in technologies and materials within the last few years has dramatically changed the work of dental technicians. We are, however, still often faced with a huge challenge: to recreate nature's perfection and provide oral harmony. In particular, consistency and discipline are needed to fabricate anterior teeth. In order to produce an esthetic restoration, the dental technician must recognize the correlation between the tooth shape, surface structure and function and the effects of phonetics and colour. These factors form the foundation.

With a passion for the work involved and the necessary sensitivity and specialized knowledge, a lifelike appearance can be successfully imitated. At times this can be a laborious task and require a great deal of patience and sometimes it takes quite a few attempts to achieve the desired results. In order to realize a harmonious and esthetic smile in the end result, good communication between the patient and dental technician is essential. The patient's expectations must be clearly understood by all parties and their wishes transposed as a team. This article concentrates on shade selection and shade reproduction using the veneering ceramic IPS e.max® Ceram. The fabrication of an anterior tooth is shown on the basis of a patient case.

The visual properties of natural teeth

Three shade characteristics must be taken into account when determining the shade: the colour (Hue), the brightness (Value) and the colour intensity (Chroma). The colour itself is the most obvious part of a shade. The brightness is a definition of how light or dark a colour is. The colour intensity describes the purity of a colour. The highest attention should be paid to the brightness. If the value of a restoration is not ideally matched to the rest of the dentition, then even the slightest deviation can be detected within normal speaking distance by the person standing opposite.[2] In general, it is very important to understand the three visual properties and use the chosen ceramic system to adapt to each situation individually.

The principles of shade selection

For shade selection a shade guide is used, which presents the following colour tones:

A = orange
B = yellow/orange
C = grey/orange
D = brown/orange

The shade should be selected at the start of the restorative treatment so that it is not affected by a dehydrated natural tooth structure. In order to select the hue, value and

[1] Bastian Wagner
Dental Practice Dr Markus Regensburger
Effnerstrasse 39a
81925 Munich
Germany
wagner.zahntechnik@gmail.com

Figure 1: Individual shade samples for the ceramic range IPS e.max Ceram.

chroma, individually fabricated shade samples in the relevant ceramic assortment can be useful (Fig. 1). The ceramic materials are designed in such a way that the complex shades and characteristics of natural teeth can be better distinguished. The colour of the gingiva or other surrounding influences can affect the shade selection. For example, the background colour during shade selection can change the perception of the colour intensity and the colour tone. In order to avoid any misinterpretation it is advisable to cover the dark oral cavity with a grey card. Another method is to use a gingiva coloured holder (Gumy, Shofu, Germany) for each individual shade sample in order to provide simultaneous and successive contrast effects. The samples are surrounded by a colour which imitates their natural environment. The Gumy gingival mask is available in four different colours. When a shade is selected, the sample is then placed into the Gumy so that it can be checked with the gingiva. For basic shade determination it is advisable to take a photo of three different shade samples on one photo. This provides a comparison. One sample should represent the brightness of the tooth to be prepared; the second should have a lower value and the third a slightly higher value. Furthermore, during the preoperative shade determination, important information on the selection of a suitable material should also be considered.

Photographic documentation of the shade selection

In an addition to the shade selection, photo documentation is essential. A photographic shade comparison of the natural tooth colour and the corresponding shade tabs provides further details. In general, digital photography is a unique communication tool for the entire treatment team and it should be firmly established within the treatment process.[1] When taking photographs, the following procedure must be observed. The shade sample and the natural tooth must both be parallel to the sensor level on the camera and receive the same amount of light exposure as the camera flash. The shade information in the photograph and the anatomical and morphological characterization can then be analyzed on the screen. In order to avoid falsified information on the screen, it should be calibrated perfectly. If a grey card is used whilst photographing, differing camera values can be corrected using white balance with the image-editing program (e.g. Adobe Photoshop Lightroom). Information is not lost or distorted. When the photos are converted in the image-editing program into black and white pictures, the surface texture and difference in brightness is clearly visible. To better identify internal characterization, the contrast control can be adjusted to "maximum" and the highlight function to "minimum". This will show all details clearly. The collected information is converted into a shade diagram, which is synchronized with the ceramic material to be used, and a layering concept is created. The following case shows one possible procedure for realizing the determined tooth shade.

Patient case

This patient case with the reconstruction of tooth 11 shows clearly how the determined shade can be reproduced. The preoperative shade analysis shows that the adjacent tooth 21

Figure 2: Reconstruction of tooth 11. Shade determination at the beginning.

Figure 3: Shade determination with gingiva coloured holder for the shade samples.

Figure 4: Shade determination of the internal structures.

Figure 5: Selection of the individual opal materials using self-fabricated shade samples.

has a very high degree of brightness in the cervical area and in the body (Figs 2 and 3). The natural tooth exhibited opalescent/ transparent areas on the ridges and in the incisal region. The mamelon structure had a high value and a slightly yellowish chroma (Figs 4 and 5). The basic shade selected was BL 3. Various methods can be used to increase the brightness of the IPS e.max Ceram ceramic. In this case, due to the high degree of value, the brightness of the dentin B1 ceramic material was increased with the highly fluorescent MM light ceramic material from the IPS e.max range. The framework material used was an MO1 press ingot (Fig. 6).

The structure was lightly covered in a wash bake with MM light and then fired (Fig. 7). During the first dentin bake, the framework was evenly covered with dentin B1 and MM light. The area towards the ridge which had a high degree of value was imitated using Deep Dentin B1 and MM light to a ratio of 4:1 (Fig. 8). The tooth shape was then completed using Dentin BL 3 (Fig. 9). Cutting back the incisal area and the edges made space for the Effect materials. Before the actual build-up, in order to create the mamelon structure, the material MM light was mixed with Essence Lemon and White until the ideal mixing ratio had been found and then a firing sample

Figure 6: The crown framework IPS e.max Press (MO1 ingot) before the wash bake.

Figure 7: Wash bake and characterisation with MM light before firing.

Figure 8: The crown framework was built up with Dentin B1 and MM light and Deep Dentin and MM light (ratio 4:1) was built-up towards the edges.

Figure 9: Completion of the internal structure with Dentin BL 3.

Figure 10: Application of the mamelon structure with a mixture of MM light and Essence materials.

Figure 11: Completion of the incisal plate with Opal materials.

Figure 12: Results after the first bake.

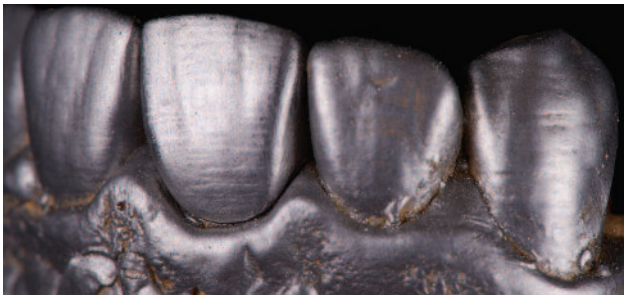

Figure 13: Checking the surface structure.

Figure 14: The finished piece of work after the glaze firing.

Figure 15: The finished restoration of tooth 11 in situ.

was fabricated. The exactly mixed ratio was then applied to the incisal plate (Fig. 10) and the edges were built up with OE 1. The incisal plateau was completed by alternately layering OE 2 and OE 3 (Fig. 11). Finally, the halo-effect was imitated from the incisal edge to the proximal area and the crown was then fired (Fig. 12). The second bake included slight shape corrections. To achieve a natural appearance the ceramic surface was given structure and then fixed with a glaze bake (Figs 13 to 15).

Conclusion

The diverse spectrum of a modern ceramic range gives the technician the ability to reproduce a variety of dynamic light features. Recognizing and realizing the tooth shade is and always will be a huge challenge. This is why the intensive study of chromatics and of your own ceramic assortment is essential. Even though the material prerequisites for reproducing lifelike restorations are available, each dental technician is responsible for developing their own skills and capabilities. The challenge of recreating a shade will always be unique for each different patient case.

In autumn 2015, Ivoclar Vivadent introduced the IPS e.max Ceram Power Dentin and Incisal layering ceramics which feature a high brightness value. These materials are ideal for use on less reflective translucent substructures. In cases such as the one presented in this article, in which a high degree of brightness is required, the Power materials can also be used on opaque frameworks to realize the desired results with little effort.

Literature available from the editors on request

Reprinted with permission by Reflect 1_2016