Complex esthetic and functional rehabilitation using glass-ceramic materials

Given the enamel-like properties of glass-ceramic materials, minimally invasive treatment options provide a reliable method to restore the function, esthetics and biomechanical characteristics of the dentition while minimizing the damage to the biological structures.

By Prof. Dr. Daniel Edelhoff and Oliver Brix, Germany

Resin-bonded single-tooth glass-ceramic restorations such as veneers and onlays have been used for many years in dentistry. Nevertheless, their use for complex restorative indications – e.g. in patients with generalized hard tissue defects – is still critically discussed. These reservations can be increasingly abandoned in view of the beneficial preliminary results reported in controlled clinical studies and the experiences gained in specialist practices. It is essential for the long-term and reliable application of this method to accurately coordinate the stages between the dentist and technician and allow the patient to be actively involved. These stages consist of a careful treatment planning process including a study wax-up/mock-up (esthetic evaluation of the wax-up and customized using the staining technique (IPS Empress® Esthetic). Full-contour onlays and glass-ceramic veneers were placed in the layering technique (IPS Empress® Esthetic) and customized using the staining technique (IPS Empress® Esthetic).

Clinical indications for application of glass-ceramic restorations include:
1. Minimal invasive crown lengthening and periodontal surgical procedures
2. Glass-ceramic crowns would be used for most of the cases
3. Finally restoration was to be achieved using adhesively bonded glass-ceramic veneers and onlays. Glass-ceramic crowns would be used for those teeth that were severely damaged.

By the help of a diagnostic matrix and the provision of rubber dam isolation, treatment planning has to be provided in the wax-up based on a minimal invasive procedure and tooth-coloured restorations. Treatment planning was to be achieved using adhesively bonded glass-ceramic veneers and onlays. Glass-ceramic crowns would be used for those teeth that were severely damaged.

Crown lengthening and periodontal surgical procedures
1. Final restoration was to be achieved using glass-ceramic veneers and onlays. Glass-ceramic crowns would be used for those teeth that were severely damaged.
2. Fabrication of a study wax-up to assist in the creation of an adequate esthetic and functional tooth morphology
3. Final restoration was to be achieved using adhesively bonded glass-ceramic veneers and onlays. Glass-ceramic crowns would be used for those teeth that were severely damaged.

Recall after more than eleven years
At a follow-up examination conducted more than eleven years after the restoration had been placed, 15 posterior onlays were retained in an undamaged state (Figs 6a and b). However, cracking had been noted on the glass-ceramic onlay of tooth 24 after more than six years of clinical performance. For this reason, the onlay had subsequently been replaced. Close inspection of the mandibular anterior veneers revealed a severe wear facet on veneer 43 (Figs 7a to c). Similar to the other veneers, this area was in direct contact with the lithium disilicate crowns on the maxillary anterior antagonists during dynamic occlusion.
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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 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 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 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 holo-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.

Moreover, 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 exactly the same shade system with the tab? There are many shade taking systems available, with variations in the shades between different manufacturer's, even though the concept might 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 JD master shade guide. 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 the best tool for identifying and communicating the correct dental shade. Tooth color can be referred to as being an A3 or A4, between a B2 and B3 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 6600°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 between the same shades can be considerable. A good photo for both the dentist and the lab technician can be emailed so that they both look 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 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 CITT (Jürgen Léger, 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 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 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 adequately express tooth translucency.

Conclusion
Given the enamel-like properties of the glass-ceramic material, the mini-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 (Figures 6 to 10). Beneficial clinical long-term results have been described and confirmed in several studies [3, 8]. Parafitt and others, endodontically treated teeth and an adequate amount of enamel have, among others, been flagged as risk factors influencing the success of these restorations [3, 22]. 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 onlays [10]. It is therefore important to note that preparations should have soft and rounded tran-