Minimally invasive inlay restoration using the VITA ENAMIC hybrid ceramic

By Dr Gerhard Werling, Germany

Inlay restorations using CEREC procedures (Dentsply Sirona) have been an established process in digital dentistry for decades. However, owing to the required minimum wall thickness, a great deal of tooth substance frequently had to be removed in reconstructions using conventional ceramics. Owing to reduced minimum wall thickness, VITA ENAMIC (VITA Zahnfabrik) allows for minimally invasive restorations and can be precisely ground to thinly tapering edges. In this case report, I explain the clinical procedures for an inlay restoration using this hybrid ceramic on teeth #24–26.

Initial situation

Figures 1 and 2 show the initial situation of the 38-year-old male patient. On the basis of his history and in accordance with his request, he was not treated with alternative methods (infiltration technique, fluoridation, regular controls, etc.). Instead, a cavity was carefully prepared on the teeth in which caries was radiographically shown to have already penetrated the approximal enamel. Surprisingly, it was found clinically that the caries had penetrated deep into the dentine, such that after extensive excavation, a considerable defect in the tooth substance was present.

Material selection

As the patient wanted a permanent enamel-like and tooth-like restoration, composite could not be used as a restorative material. It was decided to proceed according to the extension for prevention—but as minimally invasively as possible. VITA ENAMIC is very advantageous in such a case. The unique network structure in which ceramic and acrylic polymers interpenetrate provides for enormous resilience and offers more freedom than conventional restorative materials do.

CAD/CAM workflow

Three VITA ENAMIC inlays were fabricated using the CEREC system (Sirona Dental Systems, now Dentsply Sirona). The intraoral scan was performed using the CEREC Omnicam. With the bi-ogeneric software, the reconstruction was done corresponding to the missing occlusal surfaces. In the grinding preview, the inlays were placed in the material blanks. The EM-10 (8 × 10 × 15 mm) geometry was chosen according to the shade determination with VITA Easyshade (VITA Zahnfabrik) in Shade IM2.1HT. The hybrid ceramic can be processed very simply and quickly by machine and manually. Owing to the high load-bearing capacity and edge stability, constructions with comparatively thin wall thicknesses and thin edges are also feasible. Edge chipping, which can occur with conventional ceramics, is rare with this material.

Processing and integration

It is advantageous that there is no firing process, and shade characterisation is possible if desired. The available shade selection (OM1–OM2) in two translucency levels and the good light transmission of the material allow for aesthetically pleasing results. The inlays were polished to a high gloss with the VITA ENAMIC Polishing Set in the clinic. The hybrid ceramic can also be easily polished intra-orally. With VITA polishing instruments, the restoration edges can be finely polished so that virtually no transition between the tooth and the restoration remains visible. Bonding is performed adhesively.

“Virtually no transition between the tooth and the restoration remains visible.”

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Fig. 1: Radiographic situation: does the apparent caries have to be treated or can it be addressed with alternative methods?—Fig. 2: Care was taken with the careful preparation of a cavity, but in the course of the excavation, there were clinically extensive undermining defects.—Fig. 3: Extension for prevention—but as minimally invasively as possible.—Fig. 4: The digital impression was taken with an intraoral scanner.—Fig. 5: By overlaying the opposing occlusal surfaces, the contact points could be checked.—Fig. 6: In the grinding preview, the designs were placed optimally in the blank (the inlay for tooth #26 is shown).—Fig. 7: For the adhesive bonding, absolute isolation was ensured with a rubber dam. Fig. 8: A defect-oriented restoration with composite fillings was planned. The result was a minimally invasive restoration with VITA ENAMIC inlays.
Shade analysis: See, determine, realise

By Bastian Wagner, Germany

The wide variety of ceramic materials available today allows the dental technician to reproduce the natural, dynamic light qualities of natural dentition. Determining and realising these visual characteristics, however, are challenges that can only be mastered with a great deal of patience and knowledge.

Each 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 that, with its functional, biological and aesthetic characteristics, is adapted to the individual requirements and specifications of the patient. The advancement in technologies and materials within the last several years has dramatically changed the work of dental technicians. We are, however, still often faced with a significant challenge: to recreate nature’s perfection in harmony with the surrounding dentition. In particular, consistency and discipline are needed to fabricate anterior teeth.

In order to produce an aesthetic restoration, the dental technician must determine 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 specialist knowledge, a lifelike appearance can be successfully imitated. At times, this can be a laborious task and require a great deal of patience; sometimes, it takes quite a few attempts to achieve the desired results. In order to realise a harmonious and aesthetic smile in the end, good communication between the patient and dental technician is essential. The patient’s expectations must be clearly understood by all parties and his or her wishes transposed as a team. This article concentrates on shade selection and reproduction using the veneering ceramic IPS e.max Ceram (Vivadent Vivadent). The fabrication of an anterior tooth is demonstrated based on 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 refers to how light or dark a colour is. The colour intensity describes the purity of a colour. The greatest attention should be paid to the brightness. If the value of a restoration is not ideally matched to the rest of the dentition, even the slightest deviation can be detected within normal speaking distance by the person standing opposite.

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 chroma, individually fabricated shade samples in the relevant ceramic assortment are useful (Fig. 6). 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) for each individual shade sample in order to provide simultaneous and successive contrast effects. The samples are surrounded by a colour that 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 against the gingiva. For basic shade determination, it is advisable to take a photograph of three different shade samples on one photograph. 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 pre-operative shade determination, important information on the selection of a suitable material should be considered.

The principles of shade selection

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

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

The shade should be selected based on different shade samples on one photograph. 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 pre-operative shade determination, important information on the selection of a suitable material should be considered.
Photographic documentation of the shade selection

In an addition to the shade selection, photographic 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 from the camera flash. The shade information in the photograph and the anatomical and morphological characteristics can then be analyzed on the screen. In order to avoid falsified images, the surface texture and difference in brightness are clearly visible. In order to better identify internal characteristics, the contrast control can be adjusted to “maximum” and the highlight function to “minimum”. This will show all of the 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 demonstrates one possible procedure for realizing the determined tooth shade.

Patient case

This patient case with the reconstruction of tooth #11 illustrates clearly how the determined shade can be reproduced. The pre-operative shade analysis showed that the adjacent tooth #21 had a very high degree of brightness in the cervical area and in the body (Figs. 2 & 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 & 5). The basic shade selected was BL3.

Various methods can be used to increase the brightness of the IPS e.max Ceram ceramic. In this case, owing 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 MO 1 Pressingot (Fig. 6). The structure was lightly covered in a wash bake with MM light and then fired (Fig. 7).

During the first dentine bake, the framework was evenly covered with Dentin B1 and MM light. The area towards the ridge that had a high degree of value was imitated using Deep Dentin B1 and MM light in a ratio of 4:1 (Fig. 8). The tooth shape was then completed using Dentin BL3 (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 was fabricated. The exactly mixed ratio was then applied to the incisal plate (Fig. 10) and the edges were built up with OES. The incisal plateau was completed by alternately layering OES2 and OES3 (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. In order to achieve a natural appearance, the ceramic surface was given structure and then fixed with a glaze bake (Figs. 13–15).

Conclusion

The diverse spectrum of a modern ceramic range gives the technician the ability to reproduce a variety of dynamic light properties. Determining and realizing the tooth shade pose significant challenges. This is why the intensive study of chromatics and of one’s own ceramic assortment is essential. Even though the material prerequisites for reproducing lifelike restorations are available, each dental technician is responsible for developing his or her own skills and capabilities. The challenge of recreating a shade will always be unique for each 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 sub-structures. 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.

Editorial note: A list of references is available from the publisher.

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Non-precious dental alloys on nickel-chrome base System KN and System NH
Non-precious dental alloys on cobalt-chrome base System NE and System Duro
Partial alloy System MG
CAD/CAM discs on cobalt-chrome base System NE-Blank and System Soft-Blank
CAD/CAM discs on titanium base System Ti-Blank
Investment for crowns and bridges ADENTA-VEST CB
Investment for partial denture ADENTA-VEST PA

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Fig. 9: Completion of the internal structure with Dentin BL3.—Fig. 10: Creation of the mamelon structure with a mixture of MM light and Essence materials.—Fig. 11: Completion of the incisal plate with Opal Effect materials.—Fig. 12: The results after the first bake.—Fig. 13: Checking the surface structure.—Fig. 14: The finished piece of work after the glaze firing.—Fig. 15: The finished restoration of tooth #11 in situ.