All- ceramic crowns on endodontically treated central incisors

Jan Hajtó,[1] Stefan Frei[2]

Discoloured teeth are often the result of endodontic treatment. Although metal-ceramic crowns may cover even severely discoloured tooth structure, the metal frame often causes the areas beneath the crown margins to appear dark. The framework does not allow light to pass through the remaining tooth structure and the dark margins of the metal substrate show up in the visible area even if only minimal gingival recession occurs. Since metal-ceramic restorations have been the standard in dental restorations, including anterior crown reconstructions, for several decades, many patients have come to regard these dark rims as the inevitable consequence of "tooth crownings". All-ceramic materials, and especially translucent glass-ceramics, offer all the esthetic advantages required for anterior restorations, but they are often associated with limited strength. Lithium disilicate presents a material that, for the first time, combines high strength with natural translucency. The following case report highlights the strengths of IPS e.max® Press.

[1] *Dr Jan Hajtó*
[2] *Stefan Frei, MDT, Munich/Germany*

Contact details:
Dr Jan Hajtó
Weinstrasse 4, 80333 München, Germany, dr.jan.hajto@t-online.de

Stefan Frei, MDT
Frauenstrasse 11, 80469 München, Germany

Figure 1: Preoperative situation: existing metal-ceramic crowns on teeth 11 and 21. In addition to the dark crown margins, the bluish discoloured gingiva on tooth 21 caused dissatisfaction.

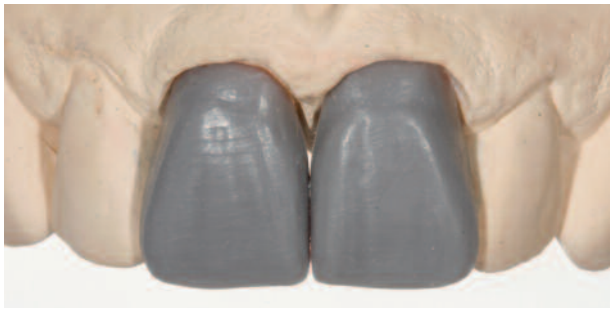

Figure 2: In the wax-up we established a crown shape that was characteristic for the patient and created an optical distraction from the slightly flawed gingival esthetics.

Figure 3: Situation after removal of the crowns, cleaning of the remaining tooth structure and post extraction on tooth 21.

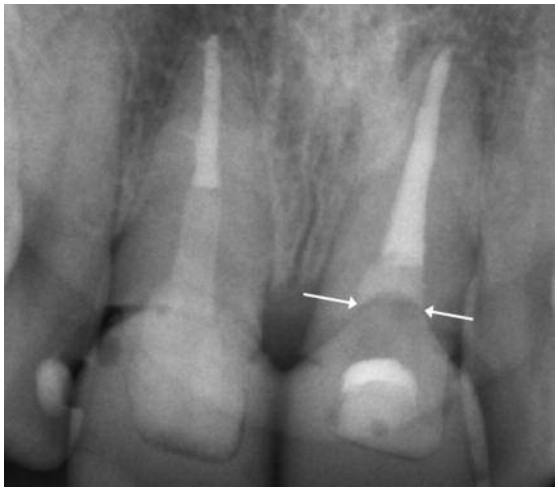

Figure 4: X-ray examination after root canal obturation and glass fibre post insertion in tooth 11 and revision of 21; the root canal filling was covered with a glass ionomer cement before internal bleaching (3% H2O2 and sodium perborate) was applied.

Preoperative situation and treatment planning

A 40-year-old female patient required a functional overhaul of her dentition, including an increase in the vertical dimension. In addition, the two existing metal-ceramic crowns on the central incisors were in need of replacement. The patient was bothered about the clearly visible dark areas beneath the crown margins. The gingival tissues looked slightly bluish on the cervical side of the crowns, which was an indication of discoloured underlying tooth structure (Figure 1). An X-ray examination revealed an inadequate root canal filling on tooth 21.

Tooth 11 had not previously been treated endodontically, yet it did not show any signs of sensitivity when it was exposed to vitality testing. Since the central incisors play an essential part in the esthetic appearance of the anterior region, even straightforward cases like this necessitate a careful approach to planning. Creating a wax-up in the run-up to implementing the restoration is required even, or especially, for cases that involve only one or two incisal crowns. In the present case, the existing crowns did not match the characteristics of the patient well. Our aim was to find a more expressive and daring shape to optically distract from the shortcomings of the gingival esthetics. The central papilla in particular was somewhat too short. We therefore decided to use a triangular shape for the crowns (Figure. 2).

After the existing crowns had been removed, the shape of root canals showed that the teeth must originally have been in a severely protrusive position and the remaining tooth structure had been heavily cut on the labial side to amend this position. As a result, tooth 11 showed long standing damage to the pulp cavity with a symptomless necrotic pulp, which required endodontic treatment. Both root canal systems were discoloured to different extents (Figure 3). Such discolouration can usually be easily brightened up by internal bleaching. However, if this step is performed, a tight root canal filling is indispensable to protect the periapical tissue from contact with the bleaching agent. Tooth 11 was endodontically treated and the existing root canal filling of tooth 21 was revised. Subsequently, both root canals were obturated with liquid gutta percha (Figures 4 and 5).

As the remaining tooth stumps were very short and we had to ensure appropriate retention of the temporaries, we decided to rebuild tooth 11 with a glass fibre post and an adhesive composite build-up (Tetric EvoCeram®). Figure 6 shows tooth 21 after the endodontic treatment, bleaching with sodium perborate and 3% hydrogen peroxide and adhesive post build-up.

Subsequently, the tooth stumps were subjected to external bleaching with 30% hydrogen peroxide whilst a rubber dam was in place to whiten the relevant areas beneath the crown margin. After this process, the tooth structure was bright enough to act as substrate for the translucent glass-ceramic IPS e.max Press restorations (veneered with IPS e.max® Ceram). Because we used post build-ups, we were able to prepare an ideal circular reduction of approx. 1 to 1.5 mm. This provided the technician with sufficient space to create an individualized veneer.

Figure 5: Direct temporary. The shape still resembled that of the previous crowns.

Figure. 6: Result after the endodontic treatment, bleaching and adhesive post build-up. Both teeth had been additionally whitened from the labial aspect whilst a rubber dam was in place and tooth 21 also received a glass fibre post.

Indirect temporaries

The splinted direct temporaries were esthetically not satisfactory. We therefore decided for lab-fabricated provisionals as a prototype restoration. These restorations do not represent a classic "long-term temporization", because they allow the esthetic, functional and periodontal integration of the restoration to be evaluated already after a few days or weeks. Without this intermediate step, the final outcome would have been subject to many more variables, especially because we were trying out a somewhat more daring tooth shape in this case. It is crucial that the temporaries and final restorations are created by the same person. This is not the case if direct temporaries are used.

If possible, the lab-fabricated temporaries are not splinted. The patient was satisfied with the provisional result, as shown in Figure 7. However, it turned out that these crowns were slightly too long, resulting in premature contacts during extreme protrusive movements. This inconvenience was easily eliminated on the temporaries before the final crowns were fabricated.

Crown fabrication

Since our aim was to cover the discoloured dark cervical area of tooth 11 and to achieve a maximum level of brightness in both crowns, we opted for an IPS e.max Press framework based on an MO ingot (MO = Medium Opacity). The medium opacity was chosen to prevent the crowns from absorbing too much incident light and therefore to avoid that they would appear greyish. Enough space was available to adhere to the stipulated minimum thickness of 0.6 mm without difficulty. To ensure that the stipulated maximum layer thickness of the IPS e.max Ceram layering ceramic was not exceeded, the dimensions

Figure 7: The lab-fabricated temporaries at the try-in. A dark retraction cord is shining through the gingival margin of tooth 21.

Figure 8: The frameworks were fitted on the model and adjusted. After wash firing and individual characterization (Essence materials), they were prepared for the application of the veneering ceramic.

Figure. 9: Dentin layering (Dentin A2 and A3).

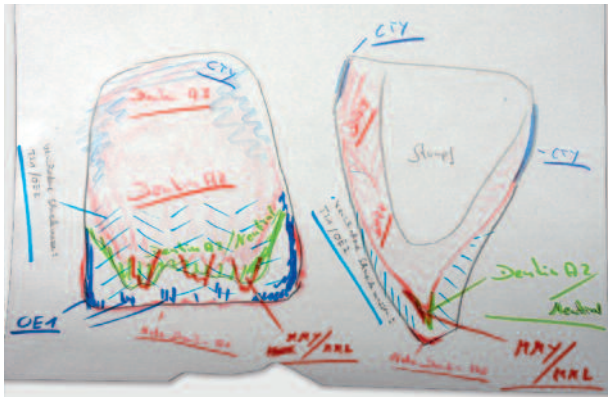

Figure 10: Layering diagram established by the dental technician.

Figure 11: The restorations were polymerized from all sides for a few seconds to facilitate the removal of surplus material.

Figure 12: Excess removal with a pointed probe.

of the framework were designed as large as possible using the highstrength lithium disilicate glass-ceramic (Figure 8).

The dentin body was built up with ceramic materials of various intensities using a palatal matrix as an auxiliary (Figure 9). Opalescent incisal materials were used to extend the core and characterizations were applied with mamelon materials (MM yellow, MM light). The shape was completed with Incisal and Opal Effect materials (TI 1, OE1, OE2).

Figure 10 shows the complete anterior and sagittal layering diagram with the ceramic materials used. After the restorations had been fired and reworked, minor adjustments were implemented and then the crowns were prepared for glaze firing.

Adhesive crown cementation

The restoration met with a high level of acceptance from the patient at the try-in. If possible, we avoid the temporary seating of all-ceramic restorations because we feel that the risk of causing a fracture during the removal is too high. It is important to allow the patient ample time to assess the crowns under different light conditions (i.e. day light in particular).

Adhesive cementation was performed with Multilink® Automix. The internal surfaces of the crowns were cleaned with Ivoclean after the try-in to remove any residual saliva. Then these surfaces were silanized with Monobond® Plus. The tooth preparations were meticulously cleaned and roughened by blasting with 50 µ aluminium oxide corundum. This step also increases the wettability of the surfaces, facilitating the application of the two-component primer (Multilink Primer A&B). The primer improves the curing performance of the luting composite.

Multilink Automix was applied in a homogeneous, bubble-free layer directly into the crown by means of a mixing tip. After the crown had been seated, the excess material was polymerized for a few seconds (Figure 11) and effectively removed (Figure 12). Multilink Automix is a self-curing material that offers the option of light-curing to speed up the polymerization process in conjunction

Figure 13: The treatment result at the check-up. The dark shadow above tooth 21 has completely disappeared.

with translucent crowns. All residual material should be meticulously removed when an adhesive cementation method is used.

Conclusion

IPS e.max lithium disilicate results in true-to-nature esthetic results. The IPS e.max Press material is selected in an appropriate degree of opacity and translucency in line with the shade of the remaining tooth structure, the target shade and the given indication. Dental technicians who have been using other ceramic systems may have to adjust their routines slightly when they begin to use the IPS e.max Ceram layering ceramic. From our own experience, however, we can affirm that it is worth changing over to this new all-ceramic system and to take advantage of this convenient combination of press and layering materials as well as to gain more knowledge about this technique in educational courses. Ceramic fractures of elaborate restorations are always a nuisance and take the joy out of esthetic dentistry. It is therefore advisable to use a material such as lithium disilicate which offers both high strength and exceptional esthetics. The translucency of this ceramic allows the light to pass through the restoration to the root, avoiding gingival shadowing (Figure 13). As a result, our artificially produced tooth replacements resemble the natural dentition even more closely. The most grateful of all are, however, our satisfied patients.

Reprinted with permission by Reflect 02/12