A lasting connection: Esthetic implant-borne single-tooth restorations. Part 1

Oliver Morhofer,[1] Bernd Kobus[1]

Introduction

Restoring complex patient cases in such a way that the tooth shades of all restored teeth are accurately reproduced even if they are restored with different framework materials requires optimally coordinated materials and appropriate technical expertise. In this respect, master dental technician Oliver Morhofer has had excellent experiences with the IPS e.max® range of materials. Below he presents a patient case which he restored with five single-tooth restorations including an implant-borne posterior restoration, for which he used the IPS e.max CAD-on technique. In the first part of this two-part report, he describes the working process from the initial stages to the try-in appointment.

The esthetic appearance of a restoration plays an essential role for modern patients. As a consequence, increasing numbers of them aim to have their teeth restored with fixed all-ceramic single-tooth restorations. The female patient of this case report presents no exception to this trend. Following detailed consultation with Dr Baris Yanik in Recklinghausen, she was given an appointment with the Recklinghausen-based ambulatory surgery centre of Dr Olivier and Dr Wienhöfer. Dr Tobias Wienhöfer inserted a root-analog Friadent® implant in the region of tooth 45 (D 3.8, Frialit 2, Dentsply Friadent, Germany). Due to the limited bone supply and a bone block augmentation, Dr Wienhöfer decided to place an XiVE® implant (XiVE D 3.8, Dentsply Friadent) in the region of tooth 46 to improve the primary stability in this area.

[1] *Oliver Morhofer and Bernd Kobus, Recklinghausen, Germany*

Contact address:
High-Tech-Dental GmbH, Große Geldstr. 18
D-45657 Recklinghausen, Germany
Tel.: +49 (0) 2361 181885
E-mail: o.morhofer@high-tech-dental.de
Internet: www.high-tech-dental.de

After the implants had been completely healed, the patient presented to the practice of Dr Baris Yanick for further treatment (Figure 1 and 2). The clinician prepared teeth 44 and 47 (Figure 3). Tooth 43 was severely discoloured because of a composite-covered metal post build-up restoration (Figure 4). It was therefore decided to include tooth 43 in the treatment plan and, consequently, to reduce the dimensions of the existing metal build-up (Figure 5).

Figure 1: The first temporary was a "quick fix" created in the dental practice...

Figure 2: ...completed without occlusal design features and was only inserted until the lab-fabricated temporary restoration was ready for incorporation.

Figure 3: The substructure had an adverse effect on the shade of the composite build-up of tooth 43.

Figure 4: Teeth 44 and 47 were re-prepared…

Figure 5: …and tooth 43 became included in the treatment plan for cosmetic reasons.

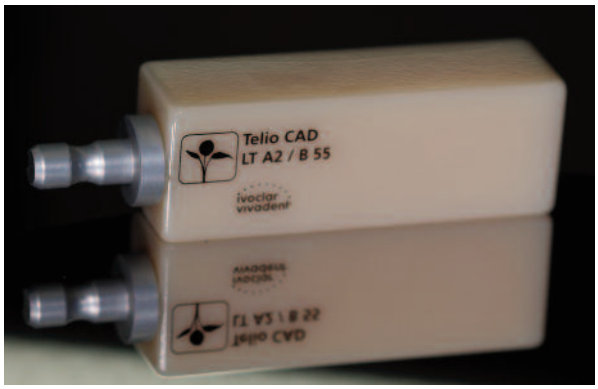

Figure 6: Telio CAD can be used to fabricate temporary single crowns, implant-borne temporaries and bridges with two adjacent pontics.

The colour of the adjacent teeth was determined individually with a shade guide to select the shade of the restoration. Shade A2 was established as the basic shade and a matching cervical shade was determined. Temporization was achieved with a temporary bridge made of Telio® CAD. This temporary material consists of industrially manufactured high-density PMMA blocks, which enable the fabrication of temporary crowns and bridges in a relatively straightforward fashion using CAD/CAM technology (Figure 6). They offer a very homogeneous texture because they are polymerized in an industrial polymerization process. In contrast to laboratory polymerized acrylic materials, industrially polymerized materials are not affected by polymerization shrinkage and do not produce an inhibition layer.

Telio CAD blocks are suitable for single crowns, temporary restorations on implants and temporary anterior and posterior bridges including up to two adjacent pontics. Telio CAD restorations can be worn in the oral cavity for a period of up to twelve months and exhibit advantageous physical properties, such as a flexural strength of 130 MPa and a modulus of elasticity of 3200 MPa. In addition, Telio CAD restorations are free of residual monomer. They therefore ensure a high degree of biocompatibility and do not irritate the mucous membrane when worn in the mouth. The highly cross-linked surfaces produce a considerably more pleasant feel on the tongue than the traditional temporary materials. Telio CAD restorations can be individualized with stains or layering materials, as desired. Consequently, they enable exceptionally esthetic results.

Exactly as recommended

In the case described, we milled a five-unit temporary restoration using an inLab® unit (Sirona, Germany), taking special care to ensure that the connectors to and between the two pontics did not fall below the stipulated minimum cross-section of 16 square millimetres.

After milling, the restoration was separated from the holder with a diamond separating disk (Komet 91PB104.180, Gebr. Brasseler, Germany) and fitted on the model with a fine tungsten carbide bur (Komet H73FSQ.104.014). Next, we used a fine cross-cut tungsten

Figure 7: The temporaries are polished to a high gloss using a handpiece and light pressure. A smooth surface finish prevents the accumulation of plaque. The patient is looking forward to receiving the final restoration all the more if the temporary is functionally and optically well designed.

Figure 8: The clinician masked the core build-ups with tooth-coloured composite to prevent the metal from shining through.

Figure 9: Happy to be able to chew again. The patient was completely satisfied with the temporary restoration.

carbide bur (Komet H129.104.23 EF) to carefully finish the crown margins, interdental spaces, occlusal areas, surfaces and marginal ridges and then smoothed the surfaces with a handpiece and white universal polishing paste. After checking the proximal and occlusal contact areas, we reworked the occlusal surfaces with a fine diamond to smooth out the surface texture created by the CAD/CAM procedure. Subsequently, we polished these areas to a high gloss with a soft goat's hair brush, cotton buff and universal polishing paste, applying light pressure and a low rpm. A high-gloss surface finish prevents the formation of plaque (Figure 7).

The experience in our own laboratory has shown us that patients are looking forward to receiving their permanent restoration all the more if their temporaries are optically and functionally well designed. We therefore usually make full use of the esthetic possibilities offered by the Telio range and its compatible customization materials, particularly if we fabricate anterior restorations and if the patient requires a highly esthetic temporization. In the present case, however, we decided not to apply any individual characterizations with stains or layering materials because the temporary was expected to remain in the oral cavity only for about four weeks.

Finally able to chew again

As is known, metal-based core build-ups may severely affect the esthetic appearance of translucent restorations. The metal disrupts the light transmitted through the restorative material and reflects it in such an unnatural way that the colour of the metal often shines through the restoration, particularly if the restoration consists of all-ceramics. As a preventive measure, Dr Yanick masked the existing metal build-ups in teeth 43 and 44 with a tooth-coloured composite (Figure 8). Together, we achieved an esthetically pleasing temporary restoration with which the patient was completely satisfied at the temporization phase, even if we did not apply any characterizations (Figure 9). She was particularly pleased with the fact that she was able to chew well again because the occlusal functions had been re-established.

A wealth of possibilities

While the patient was wearing the temporary restoration, we designed the permanent restoration in the dental laboratory. In addition to conventional crowns, we utilized the innovative CAD-on technique of the IPS e.max range for this purpose. This new technique allows veneering structures made of the highly esthetic lithium disilicate glass-ceramic (LS2) IPS e.max® CAD to be fused to high-

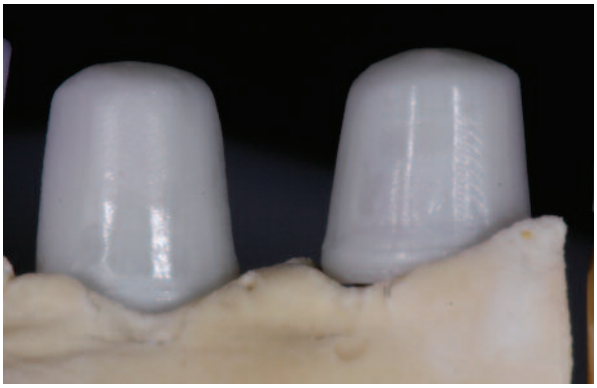

Figure 10: The implants were individually covered with shaded IPS e.max ZirCAD copings.

Figure 11: The multilayer software program allows the CAD-on veneering structure and the ZrO2 framework to be designed at the same construction step.

strength IPS e.max® ZirCAD zirconium oxide frameworks (ZrO2) by means of a newly designed fusion glass-ceramic.

The CAD-on technique involves two materials. The IPS e.max CAD lithium disilicate blocks from Ivoclar Vivadent are the first material. Upon delivery, these blocks demonstrate a white, bluish or purple colour and have a strength of approx. 130 MPa. Due to their soft consistency, they can be easily milled in a CAD/CAM unit. In the subsequent crystallization process, the microstructure of the material is transformed and the restoration obtains its final flexural strength of 360 MPa and the desired material properties, such as tooth shade, brightness and translucency.

The second material required for the CAD-on technique is IPS e.max ZirCAD framework material. The frameworks are initially milled to a 25% excess size from these pre-sintered, yttrium-stabilized zirconium oxide blocks. Subsequently, they are sintered in a Programat S1 furnace to a compact density. In the process, the frameworks shrink to their final size and obtain their exceptionally high flexural strength of more than 900 MPa combined with an excellent fracture toughness of 5.5 MPa.

Esthetic and durable

After the IPS e.max CAD veneering structure has been milled and the ZirCAD framework sintered, these two components are fused together with an innovative fusion glass-ceramic, IPS e.max CAD Crystall./Connect. This method leads to restorations that offer superior esthetic results and durability. Because of their exceptional flexural strength and stability, CAD-on restorations are suitable for posterior bridges that include up to four units and implant-borne restorations. The opaque zirconium oxide framework prevents metal abutments from shining through and is therefore instrumental in attaining a pleasing esthetic result in implant-borne restorations in particular.

The benefit of variety

In the case presented here, each preparation and implant had to be restored individually. We therefore made full use of the wide range of IPS e.max materials to achieve restorations that are as durable and esthetic as possible.
As the shade of the tooth preparation has an effect on the esthetic appearance of an all-ceramic restoration, accurate colour communication between the clinician and technician is indispensable to ensure that a ceramic block in a matching shade is selected.

To mask the core build-up on tooth 44 and the implants in teeth 45 and 46, we designed zirconium oxide copings using the inLab software program and then milled them from an IPS e.max ZirCAD block in shade MO 1 (Figure 10). A new multilayer design software (inLab 3D software V3.81) enabled us to design the CAD-on veneering structures for teeth 45 and 46 in the course of the same digital construction step. Initially, a full-contour design of the restoration is created. Subsequently, two sets of data are generated from the full contour design in a software-controlled process. These two data sets enable the framework and veneering structure to be milled independently of each other and yet in such a manner that they accurately fit together.

The ZrO2 frameworks were dried before they were sintered in a Programat S1 furnace. After sintering, the accuracy of fit was checked.

We milled the veneering structure from an IPS e.max CAD B40 block in shade HT A2 according the recommendations of Ivoclar Vivadent (Figure 11).

We designed a "veneer coping" for tooth 43 using IPS e.max CAD in shade MO (medium opacity) to create a substructure which we would then complete with individual ceramic layers to ensure an esthetic result in this visible area.

The restoration of tooth 47 was designed and milled as a

Figure 12: The veneering structures only rest on the cervical shoulder of the ZirCAD framework...

Figure 13: ... and the occlusal surfaces are smoothed out with fine diamonds, if necessary.

Figure 14: An insertion key made of Pattern Resin can be used as an auxiliary by the clinician when the restoration is tried in...

full-contour crown using IPS e.max CAD in LT A2 (low translucency).

This choice is representative of the extensive range of IPS e.max materials. The versatile possibilities of combining the individual components of this range allow users to find an ideal treatment option for nearly all indications in the dental laboratory, using fully contoured and partially contoured restorations made of zirconium oxide ceramics and lithium disilicate glass-ceramics. This system offers room for different ways of designing the restorations and finding the most appropriate treatment option for the individual patient.

Maximum reliability

The margins of the milled frameworks were carefully finished using a silicone polisher. In accordance with the recommendations of Ivoclar Vivadent, the veneering structures were tried in on the model in such a way that they only rested on the cervical shoulder of the ZirCAD framework (Figure 12). We then slightly smoothed out all the occlusal surfaces using fine diamonds and reproduced a natural surface texture (Figure 13).

An insertion key made of Pattern Resin was created for the clinician to facilitate the trying in of the individualized titanium abutments (Figure 14). Before the restoration was fused, it was tried in again to ensure that the bite transfer taken with the temporary agreed with the actual occlusion (Figure 15 and 16).

Figure 15: ... to ensure, before it is being fused, ...

Figure 16: ... that the bite transfer taken with the temporary actually matches the occlusion.