A lasting connection: Esthetic implant-borne single-tooth restorations. Part 2

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Introduction

In the second part of this report, master dental technician, Oliver Morhofer, describes the fusion technique used in conjunction with the IPS e.max CAD-on technique and discusses the results achieved in an implant-borne posterior restoration.

The IPS e.max range of materials offers an ideal treatment option for virtually every indication in the dental laboratory. The question whether a zirconium oxide (ZrO2) or lithium disilicate (LS2) material should be utilized to fabricate a restoration is usually decided by the clinician, who informs the dental laboratory of the tooth preparation, tooth shade and preferred cementation method. Within these parameters, however, the dental technician has considerable scope to contribute to the best possible outcome using IPS e.max. This system offers a comprehensive selection of materials and enables versatile combination possibilities. As a consequence, dental technicians have plenty of room for decision making in their day-to-day laboratory work and can select different routes to accomplish fixed dental prostheses that best serve the well-being of the individual patient.

In the case described here, tooth 47 was restored with a full-contour LS2 crown, teeth 46 and 45 received each a CAD-on crown (a combination of LS2 and ZrO2), tooth 44 was restored with a veneered ZrO2 crown and tooth 43 received a veneered LS2 crown.

First, the restoration for tooth 47 was designed and milled from an IPS e.max CAD block in low translucency A2. The copings to cover the two implants in teeth 45 and 46 were designed in high-strength IPS e.max ZirCAD (ZrO2) and milled from an MO 1 (medium opacity) coloured block. The copings were completed with esthetic lithium disilicate glass-ceramic veneering structures, which were fabricated using the CAD-on technique.

After all the restorations had been tried in, the full-contour lithium disilicate crown for tooth 47 was subjected to a crystallization process in a ceramic furnace (e.g. Programat® P500) using two holding temperatures (Figure 17). Figure 18 shows the molar crown immediately after the crystallization firing, during which the colour conversion takes place and the ceramic acquires its final strength of 360 MPa as a result of crystal growth.

Both the IPS e.max CAD MO 1 (medium opacity) lithium disilicate framework for tooth 43 and the coloured IPS e.max ZirCAD zirconium oxide coping for the core build-up of tooth 44 were individually veneered with IPS e.max Ceram. This layering ceramic is equally suitable for IPS e.max

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Figure 17: Full-contour lithium disilicate crown for tooth 47 before the crystallization process.

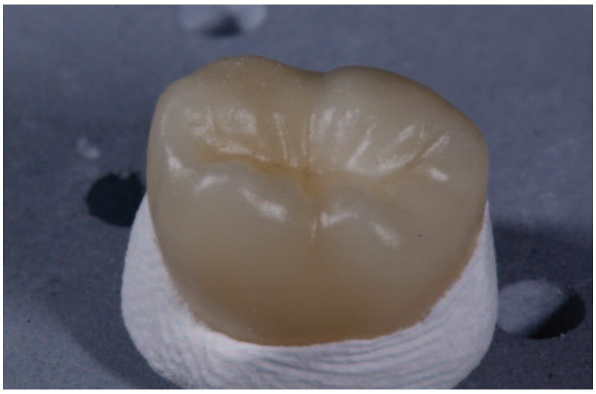

Figure 18: The same molar crown immediately after the crystallization process.

Figure 19: The lithium disilicate glass-ceramic veneers and the zirconium oxide copings have to be fused together to create the restorations for teeth 45 and 46.

Figure 20: IPS e.max CAD Crystall./Connect has been especially designed for the fusion technique.

lithium disilicate and zirconium oxide frameworks and is consequently instrumental to achieving highly esthetic restorations. IPS e.max enables dental technicians to use one and the same material to veneer frameworks made of different framework materials. Technicians are therefore no longer faced with the problem of having to use several different veneering materials for complex reconstructions involving more than one framework material. Consequently, exactly the same shade can be achieved in the restorations even if they are fabricated for different indications using different substructures. Hence, IPS e.max Ceram considerably facilitates the technician's work, particularly in the treatment of large patient cases that require the use of various restorations, e.g. veneers, onlays, crowns and bridges.

Delightful effects

The zirconium oxide coping on tooth 44 was first covered with IPS e.max Ceram ZirLiner. Using this material enhances the bond to the IPS e.max Ceram layering ceramic and creates an enhanced light transmission effect on the ZrO2 framework. ZirLiner produces a fluorescent effect on the basic zirconium oxide material, which, on its own, has no fluorescent capability. At the same time as the dentin core is built up, tooth 43 is reconstructed in individual layers, because, together with its antagonist, this tooth determines the anterior/canine guidance.

After the restoration was cut back, an incisal plate was created using Opal Effect 1 and 2 (OE 1 and OE 2) of the IPS e.max Ceram Impulse range of materials. The resultant shape was carefully filled with Transpa Neutral (TN). To complete the form, small quantities of Opal Effect (OE) violet, Mamelon salmon and Cervical Transpa (CT) orange were worked into the abrasion areas. The whole shape was covered with a thin coating of Transpa Incisal 1 (TI 1). Next, the ZrO2 coping on tooth 44 was veneered in the same way as the canine, followed by the usual occlusal and proximal adjustments and a second firing process. After the initial firing, the restorations did not show any shade differences in spite of the fact that different framework materials were used.

	Desired tooth shade																			
	BL1	BL2	BL3	BL4	A1	A2	A3	A3.5	A4	B1	B2	B3	B4	C1	C2	C3	C4	D2	D3	D4
(optional) **IPS e.max ZirCAD** shaded	MO 0				MO 1		MO 2		–	MO 1		–		MO 1						
(optional) **IPS e.max ZirCAD** non-shaded + **IPS e.max ZirCAD Colouring Liquid** *	MO 0				MO 0 + CL 1		MO 0 + CL 2		MO 0 + CL 4	MO 0 + CL 1		MO 0 + CL 3		MO 0 + CL 1	MO 0 + CL 4					
IPS e.max CAD Crystall./Connect	1	2			3	4	5	6	9	3	4	7		8	9			8	9	
IPS e.max CAD HT	BL1[1]	BL2	BL3[1]	BL4[1]	A1	A2	A3	A3.5	A4[1]	B1	B2	B3[1]	B4[1]	C1	C2	C3[1]	C4[1]	D2	D3[1]	D4[1]
IPS e.max CAD Crystall./Shade	SH 0				SH 1					SH 2				SH 3				SH 4		
IPS e.max CAD Crystall./Shade Incisal	SH I1							SH I2		SH I1				SH I2						
IPS e.max CAD Crystall./Stains	white, creme, sunset, copper, olive, khaki, mahogany																			

Table 1: The CAD-on shade system from Ivoclar Vivadent

A reliable connection

Whilst the proximal contact areas were taken into consideration, the IPS e.max ZirCAD zirconium oxide copings of tooth 45 and the premolarized tooth 46 were fused to the corresponding CAD-on veneering structures (Figure 19). Ivoclar Vivadent has developed a special fusion glass-ceramic, IPS e.max CAD Crystall./Connect, for this process. This glass-ceramic produces a homogeneous, reliable bond between the two structural components of the restoration.

IPS e.max CAD Crystall./Connect is supplied in a ready-to-use delivery form in nine shades (Figure 20). The appropriate tooth shade is achieved by combining the fusion ceramics with the light coloured IPS e.max ZirCAD frameworks or the high translucency (HT) shades of the IPS e.max CAD glass-ceramic according to the shade combination table of Ivoclar Vivadent.

A combination table is provided to facilitate the selection of the correct material. IPS e.max CAD Crystall./Connect 4 was required to achieve the final tooth shade of A2 in conjunction with the MO 1 ZrO2 framework and the HT A2 LS2 veneering structure used in the case here.

An Ivomix vibrating device is utilized to vibrate the ready-to-use fusion glass-ceramic. This device creates vibrations that are precisely matched to the consistency of IPS e.max CAD Crystall./Connect. The unopened capsule is pressed onto the vibrating plate for a few seconds until the material is homogeneously mixed (Figure 21). Note: Although the material only flows under the effect of vibration, its consistency is precisely tailored to its use! The fusion glass-ceramic is thixotropic to enable optimum fusion results (Figure 22). This means that the material becomes liquid when exposed to vibration and solidifies again as soon as the vibration is stopped. Therefore, IPS e.max CAD Crystall./Connect must never be diluted! Ivoclar Vivadent specifically warns users against diluting the fusion glass-ceramic, because if it becomes too liquid, the bond will inevitably be defective!

First, a small quantity of fusion glass-ceramic is applied to the ZrO2 framework using an IPS Spatula to prevent the formation of voids during the fusion process. Next, a small amount of Connect material is applied into the veneering structure and distributed homogenously with the help of the vibrating plate (Figure 23).

Subsequently, the framework is inserted into the veneering structure in the correct position and the two joined components are then placed on the vibrating plate for a short moment until the veneer rests on the shoulder of the ZrO2 framework. Excess fusion ceramic should now evenly ooze out from the joining gap. The restoration should not be vibrated for too long to make sure that not too much material is forced out. Surplus material is carefully removed from an occlusal, proximal and circular direction using the IPS Spatula. At the joining gap, IPS e.max CAD Crystall./Connect is evenly smoothed down.

Special shade effects

As soon as the restoration is removed from the vibrating plate, the two components are firmly joined with each other in a stable position (Figure 24). Given the thixotropic properties of IPS e.max CAD Crystall./Connect, the occlusion of the joined but not yet fired restoration can be evaluated in the articulator before the firing process is carried out.

Figure 21: The fusion glass-ceramic is uniformly mixed on an Ivomix vibration device.

Figure 22: When exposed to vibration, IPS e.max Crystall./Connect becomes liquid.

Figure 23: The fusion glass-ceramic is applied to the zirconium framework and veneering structure using a spatula.

Figure 24: The framework and veneering structure are joined together to form a stable unit.

If the fusion glass-ceramic has dried off to some degree, possible residual material may be removed with a dry brush with short bristles. Joined restorations should not be steamed off or become moist.

Concomitant with the fusion and crystallization firing step, we applied a few shade effects to the restoration using the IPS e.max CAD Crystall./Shades staining materials. (Figure 25) and then fired it at 840 °C (1512 °F) (Figure 26). During the fusion firing, the veneering structure undergoes crystallization. In the process, a homogeneous bond is achieved (Figure 27).

The topmost ceramic layer (LS2) of IPS e.max CAD-on restorations demonstrates a flexural strength of 360 MPa and, consequently, exceeds the strength of conventional veneering ceramics by a factor of three to four. Conventional veneering materials typically offer a flexural strength of 90-110 MPa and are, on average, more frequently affected by chipping than other materials. In our opinion, the CAD-on restorations offer an additional degree of reliability.

An additional firing was conducted to customize the occlusal surfaces of the crowns with Add-on and Add-on Dentin materials. After the combined correction and glaze firing, the restorations showed a vibrant, true-to-nature appearance (Figure 28).

The restorations were manually polished with silicone polishers, diamond paste and brushes. When viewed from occlusal and vestibular, the surfaces of the crowns showed well-coordinated, nearly identical shades even if the individual restorations involved different materials and core structures (Figure 29) and (Figure 30). The homogeneous quality of the surface was impressive (Figure 31) and (Figure 32).

A larger selection, a better result

The completed restorations were placed on the saw-cut model for a final check. In addition to a high accuracy of fit, the individual components were striking for their well-structured morphology, which was achieved in spite of the fact that different materials were used (Figure 33). The

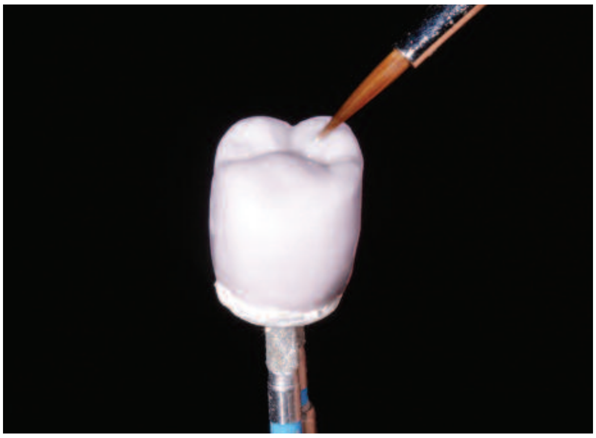

Figure 25: IPS e.max CAD Crystall./Shades staining materials are used to...

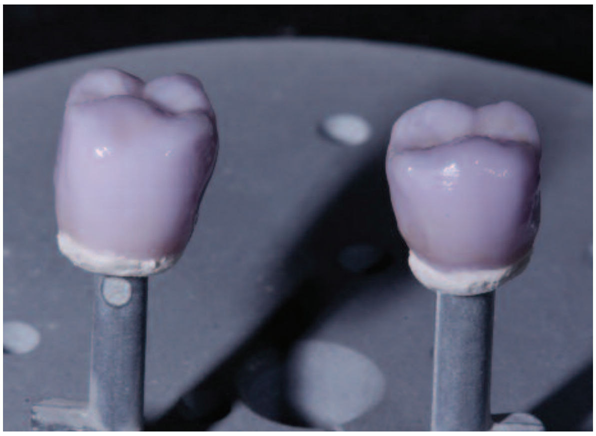

Figure 26: ... create customized shade effects.

Figure 27: The frameworks and restorations are homogeneously connected with each other after the fusion firing.

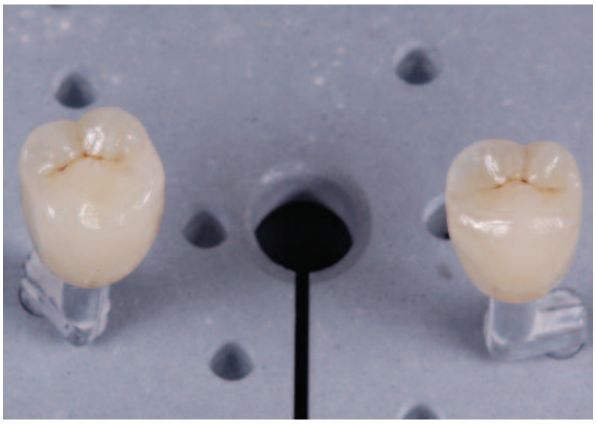

Figure 28: Additional characterizations are applied to the occlusal surfaces in a combined correction and glaze firing step.

Figure 29: Although several different framework materials have been used, the shades of the individual crowns...

proximal contact points were checked on an unsawn master model.

The view from vestibular shows the consistent dimensioning and carefully reproduced marginal ridges (Figure 34). The restorations show an optimal surface texture and morphology.

The different materials and the transitional areas between framework and veneering material are not discernible. In sum, the IPS e.max system allowed us to create optimally coordinated restorations which seamlessly integrated into their surroundings and did not differ from each other esthetically in spite of the fact that several different materials were used to produce them. IPS e.max CAD-on results in high-strength restorations that minimize the risks of fracture. They are particularly useful for use in conjunction with implants, if an appropriate emergence profile cannot be attained in the mandible because only a limited amount of bone support is available. These materials are a pleasure to work with and result in restorations that, after they are inserted, present a source of delight for the

Figure 30: ... are well coordinated with each other when the restorations are viewed from the occusal and vestibular.

Figure 31: The completely milled molar substructures and...

Figure 32: ... the fused crowns show a homogeneous surface.

Figure 33: The completed restorations are checked on the saw-cut model.

Figure 34: The crowns demonstrate an impressive shade, texture and morphology.

Figure 35: Simply beautiful – IPS e.max restorations look vibrant and are optimally adapted to each other.

patient and treatment team. (Figure 35).

Acknowledgement

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