Gold standard for chairside restorations

Highly esthetic and high-strength monolithic IPS e.max CAD restorations

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IPS e.max CAD has had a lasting impact on the dental market over the last decade. The clinical reliability of hardly any other dental material has been so well documented. Highly esthetic and high-strength monolithic IPS e.max CAD restorations have become an alternative to metal ceramics and offer a comparable survival rate.

Introduction

As dental CAD/CAM systems have become established in dentistry, the vision of producing indirect restorations in the dental practice has become reality. An intraoral 3D camera for digital impression-taking, an intuitive design software and a numerically controlled milling machine are the technologies that enable restorations to be created onsite in a short time compared to manufacturing in the dental lab. In addition to the time advantage, the digital method has also the benefit of saving resources, such as impression materials. Furthermore, the need for temporary restorations is eliminated.

Note: Adhesive bonding achieves the best values if it is performed immediately after tooth preparation.

Requirements placed on materials for chairside manufacturing

The technical prerequisites go hand in glove with materials that are suited for chairside manufacturing. Such materials should be strong enough to withstand a lifetime of use. However, very strong materials are difficult to process in a milling unit, especially since onsite manufacturing processes are expected to take only a short time. Furthermore, the material should also exhibit a tooth-like appearance in accordance with a certain esthetic sensibility. Onsite fabrication methods are not conceived for elaborate enhancements, such as ceramic veneers. The term “monolithic restoration” has become established in this context. This term describes a material that meets the requirement for adequate esthetic integration straight away, without necessitating any reworking. Furthermore, the materials should offer good conditions for adhesive bonding, especially as ever more tooth-preserving preparation techniques are preferred (Table 1).

Historical review

The beginnings of CAD/CAM fab-
IPS e.max® ZirCAD
The perfect combination of strength, esthetics and translucency

- Polychromatic MT Multi discs for efficiency and highly esthetic restorations
- High flexural strength and fracture toughness for a broad indication range
- Low wall thicknesses for less invasive preparations
- Three translucency levels (MO, LT, MT) for natural esthetics
Fig. 14: The final result in 2008: beautiful optical integration

Fig. 15: Check-up after 5 years (2013): restorations still look beautiful

Fig. 16: The UR1 and UL2 of this 23-year-old female were damaged in an accident and restored with composite material.

Fig. 17: As the result was esthetically unsatisfactory, the teeth were prepared using a planned, minimally invasive procedure.

Fig. 18: The exceptional optical properties of IPS e.max CAD Impulse O1 enable a completely natural appearance...

Fig. 19: … and provide a high brightness effect in direct light due to the high level of opalescence and fluorescence.

Fig. 20: The teeth were restored to the correct proportions and the smile line was optimized. The patient was satisfied with the result.

Fig. 21: The 3-year check-up did not show signs of ageing.

Fig. 22: A patient wearing 10-year-old veneered zirconia crowns wants her esthetic appearance to be improved. The crowns appear rather dark and grey. The preparations look unflattering.

Fig. 23: The variation in the shade of the preparations made it necessary to use a relatively opaque material that nonetheless provided a certain brightening effect.

Fig. 24: The new restorations were ground from IPS e.max CAD MT.

Fig. 25: The preparations were effectively concealed under the new crowns (cut-back method) and the brightness of the teeth was considerably increased.

Fig. 26: The final result shows a pleasing esthetic appearance.

Fig. 27: Preparation for a three-unit bridge with an esthetic pontic design.
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with an appropriate luting material, this blocks allowed the shade of the substrate to be integrated into the overall optical effect of the restoration. This meant that partial crowns and veneers could now be created with ease directly onsite in a single visit. The trend towards ever less invasive procedures led to the introduction of still another variant of IPS e.max CAD: the Impulse materials (2011). Impulse Opal O and O2 are ideal for fabricating monolithic restorations with the aim to reproduce dental enamel. Outstanding results can be achieved with comparatively minimal effort. As many users had difficulty in classifying the Impulse blocks appropriately in the product portfolio, some parts of the assortment were taken over into the recently created category MT (Medium Translucency, 2013). The IPS e.max CAD materials of the medium translucency category are mainly used to improve brightness values. Altogether, five different levels of translucency are available today. With this “toolkit”, monolithic restorations offering an utmost level of esthetics can be accomplished in a variety of clinical situations. The Shade Navigation App assists in selecting the correct translucency. In a few easy steps, this app provides useful recommendations on the selection of the correct blocks.

### Range of indications for chairside applications

The range of indications for IPS e.max CAD evolved in tandem with the provision of the blocks. The LT variant is the first choice for crowns and indications that involve “problematic” substrates. Larger blocks enable the onsite fabrication of bridges (up to the second premolar as the terminal abutment). In this case, the processing time is longer than for single-tooth restorations. With the HT variant, inlays, onlays and partial crowns can be manufactured to a high esthetic standard.

At IDS 2017, Ivoclar Vivadent launched the IPS e.max CAD 530 MPa initiative. Eleven years of continuous quality testing have shown that IPS e.max CAD provides actually a mean biaxial flexural strength of 350 MPa. This is also reflected in the consistently positive results of many scientific studies on the survival rate of IPS e.max CAD restorations (literature). In view of the consistent further development and favourable longterm clinical results, the minimum thickness recommendations for adhesively cemented IPS e.max CAD crown have been reduced to thinner dimensions. This means that preparing the teeth is easier and more tooth structure can be preserved. It also allowed the range of indications to be extended to include occlusal veneers, which have come to play a key part in raising the bite in the posterior region.

The future lies in the use of new technologies. The PrograMill One milling and grinding machine will deliver significantly better results in less time as it incorporates innovative new technology. For instance, the 5-axis turn milling technology (5 XT) uses a robotic arm, rather than a milling motor, to move the workplace. This enables a consistent milling and grinding procedure with many degrees of freedom and increased levels of accuracy. Only a minimal amount of reworking is required after the machining process. As the material is considerably easier to process when it is in its pre-crystallized blue state, corrections should be implemented directly at the grinding stage. A try-in can be performed before the crystallization process is carried out if the restoration is machined onsite (Figs 27 to 29).

Typical workflow

Preparation is mostly minimally invasive due to the high strength of the material. There are no differences with other types of restorations when it comes to optical impression-taking and computer-assisted design. The differences only become noticeable during processing in the milling and grinding machine. Lithium disilicate is a material that cannot withstand unlimited forces. Gentle processing is essential. The grinding process for a typical posterior crown takes on average 15 minutes if an MC XL milling unit is used (Dentistry Simon). The precision can be increased by using the extra fine processing option. The processing time doubles with this option. Individualized shade characterizations can be created with IPS e.max CAD: Crystal/ Shade/ Stains materials at the same time as the glaze is applied. The crystallization process takes 15 minutes in the best case when using the spray glaze (speed crystallization), otherwise it takes 25 minutes. Developed specifically for the chairside method, the Programat CS furnaces (e.g. the new Programat C14 universal furnace) provide optimum results in the shortest possible time and are therefore a sensible recommendation (Figs 30 to 34).

Thanks to the high strength of the material, several options are available for seating the restorations. Adhesive bonding should always be the preferred method. Conventional cementation is also possible but re-quires a retentive preparation pattern, which is considered outdated by today’s standard.

### Editorial note: Literature is available on request from the editors