

# Five patient cases – one concept

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All-ceramic restorations with IPS e.max.

As Aristoteles already said, beauty is sensed within symmetry. This is also the guiding principle of the authors, who describe minimally invasive methods to achieve harmony between pink and white esthetics.

Minimally invasive restorations have long become a reality due to the improvements in bonding materials and the enhanced strength of ceramic restoratives. The invasiveness of the treatment is minimized. A solid understanding of the material properties and clinical steps is essential to be able to benefit from these advances. We believe that the main cause of ineffective all-ceramic restorations can be largely attributed to human error caused by a lack of familiarity with the materials or by incorrect tooth preparation and bonding procedures. Five case studies are presented below to discuss the flow of treatment from initial examination and diagnosis to final cementation.

#### Selecting the materials

The teeth of this patient were badly stained (Fig. 1). Even after repeated bleaching, the appearance was still not satisfactory. The patient then presented to the practice wishing to have his teeth restored with veneers. Until a few years ago, all-ceramic crowns on metal or zirconia frameworks would have been the method of choice to treat such severely discoloured teeth. Now, we favour a minimally invasive approach with lithium disilicate LS2 (IPS e.max<sup>®</sup> Press). Given its high strength (400 MPa), this material is even suited for veneers with a layer thickness of as little as 0,3 mm (Fig. 2). From a wide range of shades and different levels of translucency and opacity, users can select the ideal ingot for every patient situation. Further convincing features include high accuracy of fit and excellent esthetics. Harmony and beauty are inherent in natural teeth. We must reproduce this effect with artificial materials. IPS e.max Press has enabled us to emulate the nuanced colour effects of natural teeth.



Figure 1 and 2: First case: severely discoloured teeth restored with ceramic v 12 veneers (IPS e.max Press).



*Figure 3 and 4: Second case: Following a distal cusp fracture, the tooth was restored using ceramic materials. Considering the occlusal masticatory forces, we decided to use high-strength IPS e.max Press LS2 ceramics in conjunction with the staining technique. (Fabrication of restoration: DT Takahiro Aoki).*

### Diagnosis and treatment planning

First, the patient's oral health state is assessed and the information gathered in the process forms the basis for the subsequent treatment planning. The key to success is to involve the dental lab already at this stage and to share the information gathered in the assessment process with the technician. In addition to taking the usual oral and facial images, radiographs and impressions, we also perform cephalometric analyses and jaw function tests, depending on the indication to be treated. In addition, we evaluate the esthetic characteristics. By consulting with the treatment partners, we are trying to gather as much information as possible with the aim to use this data to prepare a treatment plan in which we consider not only the tooth to be restored but the overall balance between the facial configuration and oral cavity.

### Staining technique vs cut-back technique

Although the staining technique has a favourable effect on strength, it poses limits on the esthetic design of the restoration. When we treat patients who require restorations in the anterior region, we prefer to use the refractory die method (IPS e.max Ceram) or the cut-back technique (IPS e.max Press). In the posterior region, however, we often opt for the staining technique. The result of a study conducted at New York University [Guess et al. 2010] demonstrates the high strength of monolithic lithium disilicate restorations manufactured in conjunction with the staining technique. Against such a background, we only occasionally use the layering or cut-back technique for full-coverage crowns and often choose to design the occlusal surface with IPS e.max

Press because of its high strength (Figs 3 and 4).

It is important to decide on the technique to be used prior to beginning the actual treatment to ensure that only as much tooth structure as required is removed during tooth preparation.

### Preparation

Minimizing invasiveness is one of the goals of esthetic dentistry. While the work of the dental technician may be helped by removing large amounts of tooth structure, this is not an acceptable reason for creating an unnecessarily high level of invasiveness. On the other hand, if a tooth has been prepared insufficiently, the technician may find it difficult to achieve an esthetically satisfactory restoration in the correct shade.

Veneer restorations are incorporated by bonding the restoration material to the tooth structure using an adhesive technique. Although the materials for adhesive bonding have been improved to enhance the bond strength to dentin, the preparation borders should nonetheless be limited to the enamel to attain reliable adhesion. Generally, the shape of the preparation is designed by taking both esthetic and biomechanical aspects into account. For this purpose, a silicone key may be created on the basis of the diagnostic wax-up. Indexing the tooth horizontally into three areas (cervical, coronal and incisal) allows the amount of tooth structure that is being removed during preparation to be checked. Additionally, a guide in the shape of the final tooth preparation may be used as a reference in complex micro-veneer preparations. Preparation is performed under a microscope. Using a microscope results in clearly defined

margins and, as a result, facilitates the work of the technician and enhances the accuracy of fit.

### Shade selection

Esthetic restorations of discoloured teeth usually require the removal of larger amounts of tooth structure than usual. Since we began to use lithium disilicate, however, we have been able to achieve shade adjustments with minimal reduction of tooth structure. To this end, communicating the colour of the tooth preparation to the technician is essential. Photographs including shade tabs and digital shade measuring devices are examples of instruments that can be used for shade communication. While shade measuring devices are suited for objective shade evaluations, they only provide information on a limited gamut of colours. They cannot convey subtle nuances. Photographs of the teeth with the shade tabs placed next to them are better suited for this purpose. Using tooth-coloured IPS Natural Die material is particularly useful for the fabrication of veneers on discoloured teeth.

### “Transparency” – the key to esthetic restorations

When restoring discoloured teeth, we tend to select an ingot with high opacity. However, using an opaque ingot entails the risk of obtaining a “white” restoration that looks too light. Veneers should be of a similar translucency as the natural teeth. If severe discoloration is present, an appropriate translucency can be achieved by selecting an ingot in a translucent bleach shade. A masking effect is then achieved if the base material, i.e. framework, is of a certain thickness, capable of “blocking out” the severely discoloured areas while the shade of the restoration is reproduced with the veneering ceramic (IPS e.max Ceram). This approach allows the technician to achieve a sufficiently powerful masking effect whilst maintaining the translucency of the restoration.

### Try-in

Accuracy of fit is one of the success factors for an esthetic restoration. Since we started using IPS e.max Press, we have



Figure 5: Third case: Tooth 21 during the try-in of the framework with a water droplet.



Figures 6 and 7: Fourth case: If varying amounts of tooth structure have been removed, controlling the shade of the tooth preparation is tricky. In this case, teeth 11 and 21 were restored with full-coverage crowns and teeth 12 and 22 with veneers.



Figure 8 and 9: Fifth case: Spot etching prior to attaching the temporary restoration.

been able to try in the frameworks. This is not possible with veneers fabricated using the refractory die method. At the try-in, the shape, shade and marginal fit are checked.

### Checking the shape

White wax is used to contour the planned tooth shape on the framework and then the restoration is inserted in the patient's mouth for a try-in. Adjustments, such as modifications of the crown length and shape, can now be applied.

### Checking the marginal fit

Veneers may be tried in with try-in pastes. However, we use water for this purpose because water has a better fluidity. After a drop of water has been applied to the inside surface of the veneer, the veneer is placed on the tooth preparation (Fig. 5). This requires a meticulous working method under the microscope. At first, a white line appears between the preparation margin and the framework. If the marginal fit is accurate, the water penetrates and the line disappears.

### Shade adjustment by layering

In the past, if several adjacent teeth had to be restored for different indications, the restoration which allowed only little variation in shade had to be fabricated first (e.g. veneers first and then crowns fabricated to match the shade of the veneers). Given its excellent light scattering properties, IPS e.max Press allows users to fabricate all restorations simultaneously (Figs 6 and 7). We try not to change the shade of the ingot even when working with several tooth preparations showing inconsistent shades. A minute change in thickness is all that is required to control the base shade. In this way, "shade interpretation" can be simplified for shade adaptation by layering. One of the characteristics of the IPS e.max lithium disilicate ceramic is that it maintains its

translucency.

If all teeth have been reduced by the same amount of tooth structure, the challenge consists in matching the shade of the restorations that require varying build-up layer thicknesses. If the thickness of the frameworks has been maintained to match the shade by means of the framework, the amount of layering ceramic must be reduced accordingly. In this case, the luminosity of the dentin may be increased by using bleach shades and saturation may be intensified by internal staining. This method is often applied in adjacent teeth where one is vital and the other is non-vital. Preparations with varying amounts of tooth structure removal also often show inconsistent layering thicknesses and, as a result, shade matching becomes more difficult. Since IPS e.max Press is available in several levels of brightness, translucency and intensity, a satisfactory result can be achieved in such challenging situations by selecting an appropriate ingot and combining it with IPS e.max Ceram.

### Cementation

Adhesive bonding is essential to minimally invasive dentistry. In veneers in particular, adhesion by bonding plays a more important role than mechanical retention. If a veneer fails, it is often because a faulty bonding procedure has been applied.

### Placing the temporary

A temporary restoration is not simply a short-term tooth replacement. It is a therapeutic step that requires full attention. We use a transparent luting composite (Telio® CS Link) for the placement of temporaries. First, small spots of the prepared surface are etched using the spot etching technique (Fig. 8) and then a touch of bonding composite is applied to attach the temporary restoration (Fig. 9).



Figure 10: Removal of temporary luting composite.



Figure 11: Tooth surface cleaning prior to the final cementation of the veneers.



Figure 12: Completed veneer restoration.

### Pre-treating the tooth surface in preparation for final cementation

Since semi-translucent luting composite is hard to detect, caution should be taken to ensure that no residue is left on the tooth prior to final cementation (Fig. 10). Working under a microscope is recommended. The tooth is cleaned thoroughly to create a clean environment. Fluoride-free and peroxide-free cleaning procedures using a soft brush are suitable for this step (Fig. 11).

### Cementing the final restorations

For veneer cementation, we use light-curing Variolink® Veneer composite, which offers a high degree of shade stability. The sequence of steps is as follows: placement of retraction cord, cleaning of the inner restoration surface with Ivoclean, silanization and finally cementation. A rubber dam is applied

to create a dry environment for the application of the bonding material. Adjacent teeth are separated with strips. The restorations can now be seated (Fig. 12). It is important to use Liquid Strip to prevent the formation of an oxygen-inhibited layer.

### Discussion

IPS e.max Press lithium disilicate glass ceramics are compatible with minimally invasive procedures. Until recently, esthetic dentistry has been associated with the unfavourable image of reducing healthy tooth structure. However, we would like to reverse this image by pointing out that IPS e.max is a material that allows for minimally invasive methods to achieve esthetic restorations.

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