

# Innovative adhesive luting protocol

Claus-Peter Ernst<sup>1</sup>

Anterior crowns come in many different variations from purely functional to highly esthetic – depending on the requirements and means of the patient, the skill of the dental technician, the availability of materials and the preparation and cementation procedures used. Many anterior crowns that were considered to be esthetic in the past no longer meet the demands of today's patients. The example below is a case in point.

## Case presentation

When she came to our practice, the biggest wish of the twenty-year-old highschool graduate was to have the crowns on her two central incisors replaced (Fig. 1). At the age of 14, she had experienced anterior tooth trauma which apparently damaged the mesio-incisal part of the incisal edge of both teeth. In the dental practice which the patient consulted at that time, the teeth were restored with PFM crowns. Even though the extent of the trauma can no longer be assessed, today's alternative – in light of the patient's young age in particular – would most probably have been a direct composite restoration.

Figure 2 shows the two central incisors in detail from a labial aspect. Figure 3 shows an incisal view. The crowns did not exhibit any functional defects. As a result, the main treatment aim was to improve the esthetic appearance of the anterior teeth as requested. Subsequently, the patient was informed about the

<sup>1</sup> Prof. Dr Claus-Peter Ernst,  
Mainz/Germany

### Contact details:

Prof. Dr Claus-Peter Ernst  
Poliklinik fuer  
Zahnerhaltungskunde  
University Medical Centre of the  
Johannes Gutenberg University  
Mainz  
Augustusplatz 2, 55131 Mainz  
Germany  
ernst@uni-mainz.de



Figure 1: Unattractive, old PFM restorations on tooth 11 and 21 in a twenty-year-old patient



*Figure 2: Close-up photo of the functionally intact anterior crowns showing unattractive PFM work due to the metal framework showing through.*



*Figure 3: Incisal view of the existing crowns.*

treatment procedure – in particular about any possible additional preparation requiring the removal of tooth structure – and the cost of the treatment. The actual treatment started in a separate appointment.

The restorations were fabricated by the dental laboratory of Hildegard Hofmann (Mainz, Germany). Pressed all-ceramic IPS e.max® crowns were selected for this case, since they are the first choice for this type of indication. This has been confirmed by numerous clinical studies, including the recently published German S3 Clinical Practice Guideline on ceramic restorations.

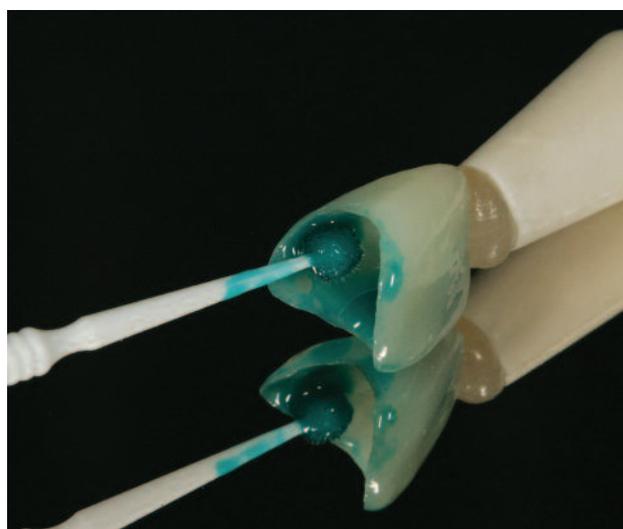
The teeth were anesthetized at the placement appointment. The crowns were removed and the bonding surfaces were carefully cleaned with ultrasound and a fluoride-free cleaning paste. Since the new Variolink® Esthetic was chosen as the luting material, the crowns were tried in with the corresponding try-in pastes. An immediate match to the adjacent and the mandibular anterior teeth was achieved with the “Neutral” shade. No adjustments were necessary with regard to a lighter (“Light”) or darker (“Warm”) shade of the luting composite. We attributed this excellent match to the fact that the dental technician had selected the shade at the chairside. The extra expense of this step far outweighs the inconvenience of having to make numerous adjustments or new restorations because of a shade mismatch.

#### **Conditioning of the crown**

Saliva and residue of the try-in paste were removed (Ivoclean) from the crowns before they were conditioned. It is advisable to fabricate a “handle”, which will allow the

inner crown surfaces to be conditioned without having to touch the crown with the fingers. In this case, the crowns were attached to a brush holder with a light-curing provisional composite. This “handle” also allowed the crowns to be placed with ease during the luting procedure. As an alternative, an OptraStick® could have been used.

Hydrofluoric acid etching of glass-based ceramics and subsequent silanization has been an accepted conditioning method for decades. The latest studies confirm its effectiveness. It even generates a strong bond on state-of-the-art ceramic materials such as hybrid ceramics.



*Figure 4: The self-conditioning ceramic primer Monobond Etch & Prime is scrubbed in for 20 seconds.*



Figure 5: Additional reaction time of Monobond Etch & Prime of 40 seconds.



Figure 6: Apical view of the IPS e.max Press crown after Monobond Etch & Prime was rinsed off.

Due to occupational safety reasons, however, hydrofluoric acid etching is considered to be one of the most critical working steps in the dental practice.

An acid concentration of 5 % has been established, which represents a reasonable compromise according to the latest research.

The new Monobond® Etch & Prime, which was introduced at IDS 2015, is an ammonium polyfluoride-based conditioning material. The product is actively scrubbed on the bonding surface (Fig. 4) for 20 seconds. In the process, it removes any contamination with saliva or silicone. After another 40 seconds (Fig. 5), the ammonium polyfluoride reacts with the ceramic surface and produces a rough etch pattern.

Even though this pattern is not as pronounced as that of conventional 20-second etching with five-percent hydrofluoric acid, the bonding results achieved in both cases are comparable. The enlarged surface created in this way helps to activate the ceramic bonding surface.

The restoration is subsequently rinsed to remove the ammonium polyfluoride and its reaction products. Then the reaction of the silane and the activated glass-ceramic begins. A thin layer of chemically bonded silane remains on the ceramic after its distribution with blown air. This product, therefore, combines the steps of hydrofluoric acid etching and silanization and it even appears to render cleaning with Ivoclean superfluos. The currently available in-vitro data justifies using this new product with due care to replace the hydrofluoric acid etching and silanizing method. Even though it has not been shown to improve the bonding values in relation to the established references, no negative effects on the adhesive bond have been found to date either. Nevertheless, since the adhesive bond to glass-ceramics is considered to be the most unproblematic interface in the bonding process of indirect restorations, no clinical irregularities are to be expected.

In the case presented, the crowns could even have been



Figure 7: Conditioning of the prepared teeth for the adhesive cementation of the restorations under cotton roll isolation. A retraction cord (Ultradent) was placed in the sulcus to prevent any contamination with sulcus fluids.



Figure 8: Incisal view of the prepared teeth.



Figure 9: Application of Adhese Universal adhesive with the pen applicator.



*Figure 10: Light polymerization of the adhesive after careful distribution with blown air.*



*Figure 11: The polymerized adhesive layer on tooth 11 and 21.*



*Figure 12: The IPS e.max crowns cemented with Variolink Esthetic DC at the follow-up examination after four weeks.*

placed by conventional or self-adhesive means. The loss of retention would have been as unlikely as the occurrence of a ceramic fracture due to inadequate adhesive support. Figure 6 shows one of the two crowns after Monobond Etch & Prime had been rinsed off and the surface dried with blown air.

#### **Cementation of the crowns**

The new Variolink Esthetic DC was used for the adhesive cementation of the crowns. As this luting system is a full adhesive, sufficient moisture control must be ensured. Due to the equigingival preparation margin, the healthy condition of the gingiva and the excellent cooperation of the patient, the placement of a rubber dam was not essential. Therefore, cotton roll isolation was used to seat the crowns. Two retraction cords (Ultradent) were placed to prevent any contamination with sulcus fluids (Figs 7 and 8).

The bonding surfaces were cleaned with a fluoride-free prophylaxis paste. Next, Adhese@Universal adhesive was applied from the pen applicator (Fig. 9). The remaining thin enamel margin was not etched to prevent any gingival bleeding. Adhese Universal was scrubbed into the conditioned tooth surface for > 20 seconds as stated in the directions for use. According to the manufacturer, this time must not be reduced: It is not enough to simply paint the adhesive on the tooth surface! Next, the adhesive was dried with blown air until an immobile, glossy film was left. Then the adhesive was light-cured for 10 seconds (Fig. 10). Since the universally compatible adhesive forms a considerably thinner film than

Heliobond, for example, it can be light-cured without encountering any subsequent problems of fit or bite elevation. The polymerized adhesive layer on tooth 11 and 21 is visible in Figure 11.

Figures 12 and 13 show the adhesively cemented IPS e.max LS2 crowns at the final follow-up appointment, four weeks after the treatment. The gingiva is free from any irritation and the crowns blend in smoothly with the surrounding teeth.

The tremendous improvement in the appearance of the front teeth, which was achieved with the all-ceramic restorations on tooth 11 and 21, is visible in the close-up photo shown in Figure 14. For the first time in many years, the satisfied patient dared to smile again (Fig. 15).

#### **Conclusion**

It takes quite a bit of courage to use innovative products and procedures, such as the ones described here. Adequate clinical data is not yet available, let alone the much needed long-term studies. Nonetheless, a start must be made somewhere. For those dental practitioners who would like to be rid of hydrofluoric acid sooner rather than later, the described self-conditioning glass-ceramic primer may offer an interesting option.

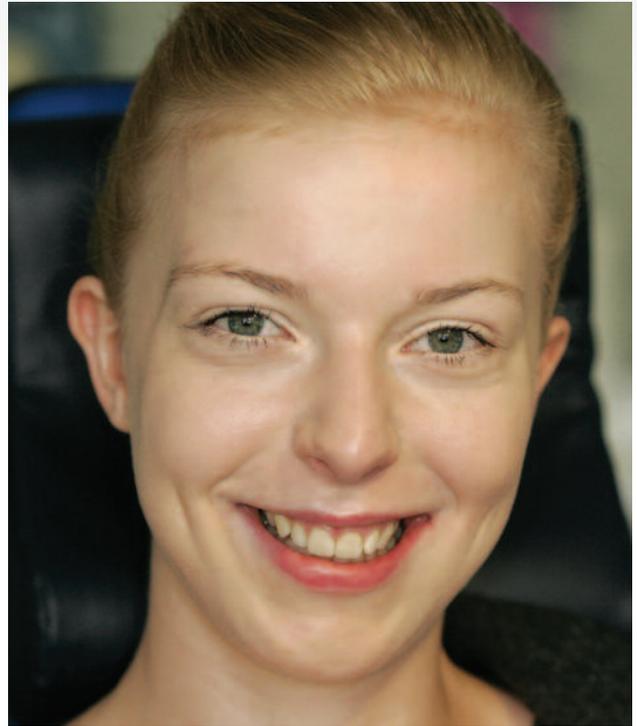
Since the etching time has a significant influence on the strength of the ceramic when hydrofluoric acid is used to condition ceramic restorations, the specifications of the manufacturer must be strictly observed. IPS e.max LS2 should be etched for 20 seconds if 5 % hydrofluoric acid is used. Other conventional glass-ceramics require 60



*Figure 13: Incisal view of the crowns at the follow-up examination after four weeks.*



*Figure 14: Front view of the anterior teeth. A significant esthetic improvement over the initial situation has been achieved..*



*Figure 15: Portrait of the happy patient.*

seconds of etching. Dentsply/Degudent recommend that their material Celtra is etched for 30 seconds. The reaction time of Monobond Etch & Prime is 60 seconds on all types of ceramics. Thus it offers a first step in the direction of error prevention. It remains to be seen if

external studies can confirm the effectiveness of the product in establishing an adhesive bond on ceramics other than those from Ivoclar Vivadent.

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