

IPS<sup>®</sup>  
e.max<sup>®</sup>

IPS e.max<sup>®</sup>

**all** ceramic  
**all** you need

CLINICAL GUIDE



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# PRESS and CAD/CAM –

## Two roads lead to all-ceramic restorations ...

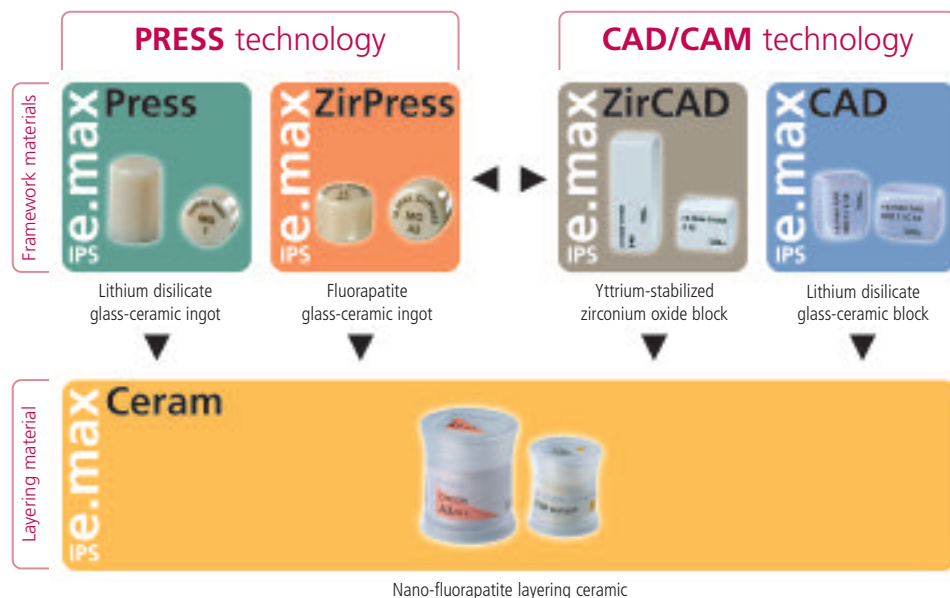
The demand for all-ceramic restorations has dramatically increased in recent years and aesthetic dentistry would be unthinkable without them. In addition, all-ceramic materials are increasingly used as an alternative to metal-ceramics.

Because of its unrivalled aesthetic properties, the IPS Empress all-ceramic system rapidly established itself as a recognized standard among the all-ceramic restoration systems. Thanks to IPS Empress, the **press technique** has evolved into a **state-of-the-art** procedure within the past 15 years.

Cost-effective **CAD/CAM procedures** and high-strength zirconium oxide ceramics for dental applications are currently experiencing a considerable upswing in popularity.

IPS e.max is the first system to combine the benefits of both, the **PRESS** and **CAD/CAM technique**, offering **highly aesthetic** and **high-strength materials** for both technologies.

**IPS e.max** allows you to provide your patients with highly personalized restorations that offer **outstanding aesthetics** and the **mechanical stability** that the individual situation demands.



... for the following indications

| Indication                     | e.max Press | e.max ZirPress  | e.max ZirCAD | e.max CAD | e.max Ceram     | Cementation                       |                              |
|--------------------------------|-------------|-----------------|--------------|-----------|-----------------|-----------------------------------|------------------------------|
|                                |             |                 |              |           |                 | adhesive                          | self-adhesive / conventional |
| Veneers                        | •           | •               |              | •         | •               | Variolink® II, Variolink® Veneer  | —                            |
| Partial crowns                 | •           | • <sup>1)</sup> | •            | •         | • <sup>2)</sup> | Variolink® II, Multilink® Automix | —                            |
| Anterior and posterior crowns  | •           | • <sup>1)</sup> | •            | •         | • <sup>2)</sup> | Variolink® II, Multilink® Automix | Vivaglass® CEM               |
| Three-unit anterior bridges    | •           | • <sup>1)</sup> | •            |           | • <sup>2)</sup> | Variolink® II, Multilink® Automix | Vivaglass® CEM               |
| Three-unit premolar bridges    | •           | • <sup>1)</sup> | •            |           | • <sup>2)</sup> | Variolink® II, Multilink® Automix | Vivaglass® CEM               |
| Three-unit posterior bridges   |             | • <sup>1)</sup> | •            |           | • <sup>2)</sup> | Multilink® Automix                | Vivaglass® CEM               |
| 4- to 6-unit anterior bridges  |             | • <sup>1)</sup> | •            |           | • <sup>2)</sup> | Multilink® Automix                | Vivaglass® CEM               |
| 4- to 6-unit posterior bridges |             | • <sup>1)</sup> | •            |           | • <sup>2)</sup> | Multilink® Automix                | Vivaglass® CEM               |
| Inlay-retained bridges         |             | • <sup>1)</sup> | •            |           | • <sup>2)</sup> | Multilink® Automix                | —                            |

1) in combination with IPS e.max ZirCAD 2) one layering ceramic for all the IPS e.max materials

#### Contraindications

- Very deep, subgingival preparations (adhesive cementation)
- Patients with severely reduced residual dentitions
- Bruxism



#### The highlights

- Highly aesthetic and high-strength materials can be combined
- One layering ceramic for the IPS e.max system
- Predictable shade results and similar clinical behaviour even in different restorations veneered with IPS e.max Ceram
- Adhesive, self-adhesive and conventional cementation

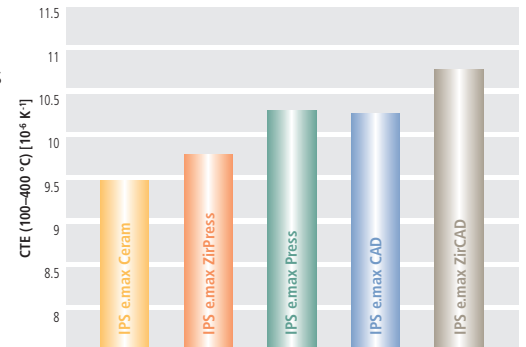


# IPS e.max Ceram –

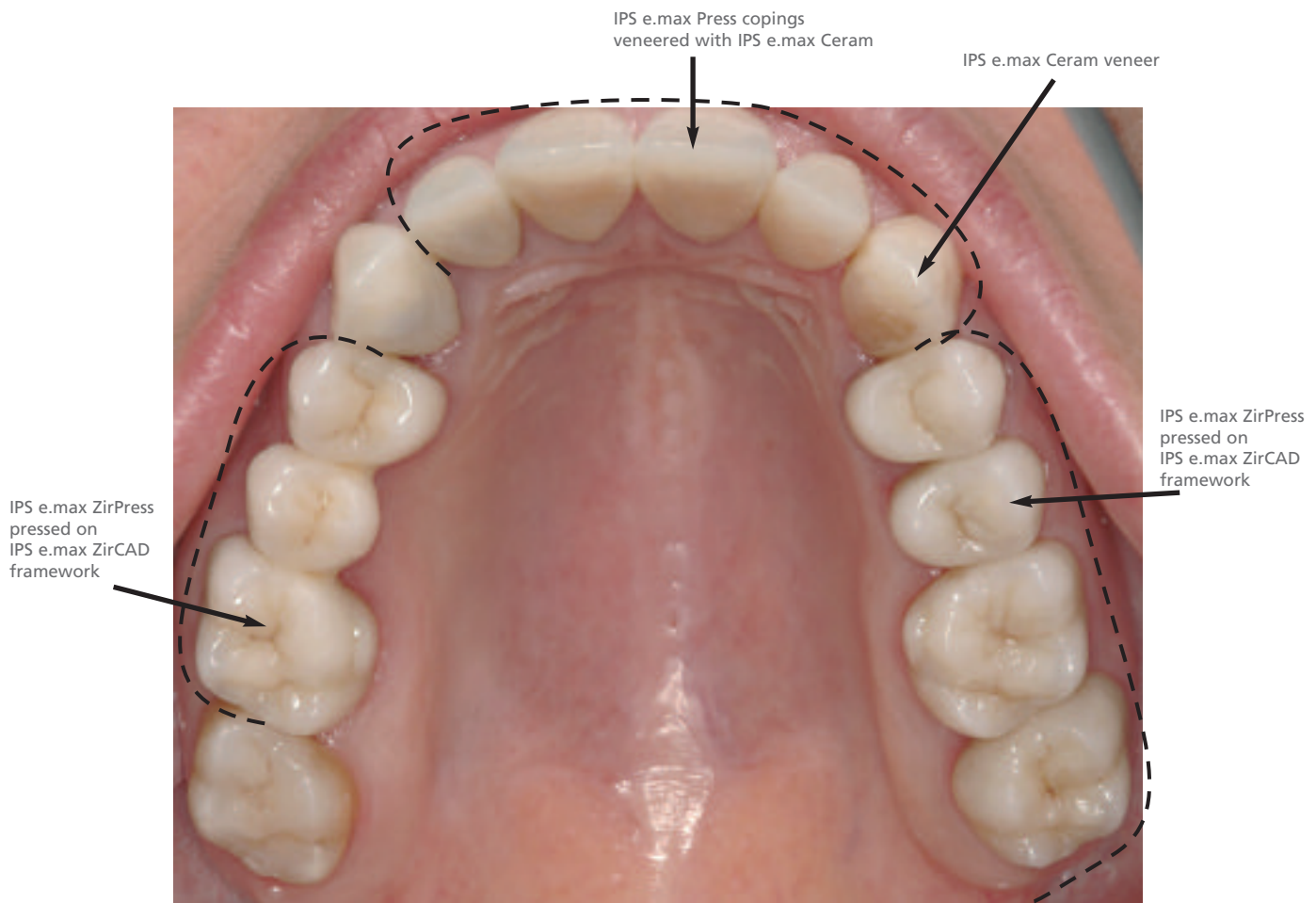
**One** layering material for glass ceramics and

Most all-ceramic systems are composed of framework and veneering materials. To date, no system has proven suitable for various indications, so that different framework materials with the matching veneering ceramics had to be used in the past.

This problem has been overcome with the new **IPS e.max Ceram** nano-fluorapatite glass ceramic. Due to its optimally coordinated firing temperature and coefficient of thermal expansion, this ceramic can be used to veneer both **zirconium oxide** and **glass-ceramic frameworks**.



CTE (coefficient of thermal expansion) of IPS e.max products  
Source: Ivoclar Vivadent, Schaan, 2005  
IPS e.max Ceram features the lowest CTE value of all IPS e.max products



# zirconium oxide

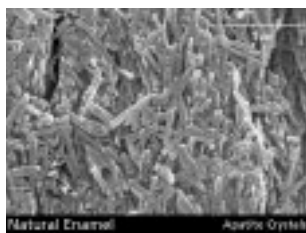
## One layering ceramic for all indications

The challenging task of having to **adjust the shade** of restorations is a thing of the past. Depending on the indication and strength required, you choose either glass-ceramic or zirconium oxide as the framework material.

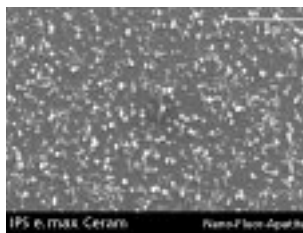
Thanks to the **one, common layering scheme**, all the IPS e.max restorations exhibit the same **wear properties and surface gloss**.



IPS e.max Ceram on four different framework materials (from left to right): IPS e.max Press, IPS e.max ZirPress, IPS e.max ZirCAD, IPS e.max CAD  
MDT Thorsten Michel, Germany



Natural Enamel



IPS e.max Ceram

The new generation of materials features a crystal structure similar to that of vital teeth.



IPS e.max Ceram on ZrO<sub>2</sub>  
in transmitted light



Competitor ceramic on ZrO<sub>2</sub>  
in transmitted light

## The highlights

- One layering ceramic for glass-ceramic and zirconium oxide frameworks
- Predictable shade results and the same clinical behaviour as regards wear and surface gloss, independent of the framework material
- Nano-fluorapatite for highly aesthetic properties

# Glass-ceramics –

## All you need for highly aesthetic restorations

Glass ceramic materials have been successfully employed in the fabrication of all-ceramic restorations for many years. They cannot only be used for the **press technique**, but also allow processing with cutting-edge **CAD/CAM technology**.



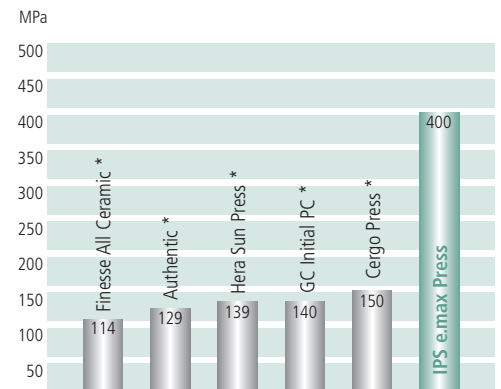
### IPS e.max Press – Tried-and-tested press technology

IPS e.max Press, the highly aesthetic lithium disilicate glass-ceramic ingots in 3 levels of translucency, offer optimized homogeneity and heightened strength and enable you to create accurately fitting restorations. Because of the high strength of **400 MPa, which is unmatched by any other glass-ceramic**, self-adhesive or conventional cementation methods can be used.

Even in cases where patients have non-vital teeth, it is possible to produce pressed all-ceramic restorations, as the IPS e.max Press range also includes high opacity ingots.

#### Indications:

- Anterior and posterior crowns
- Partial crowns
- Three-unit anterior bridges
- Three-unit premolar bridges
- Veneers



\*No registered trade-marks of Ivoclar Vivadent AG  
Source: R&D, Ivoclar Vivadent AG, Schaan



### IPS e.max CAD – The future of CAD/CAM technology

IPS e.max CAD is based on the same materials technology as IPS e.max Press. It combines the benefits of CAD/CAM processing technology with a high-performance lithium disilicate ceramic in an ideal manner. An innovative processing procedure allows tooth-coloured restorations to be produced from IPS e.max CAD blocks, which at the same time feature high final strength values (360 MPa).

The blocks are available in 2 levels of translucency. IPS e.max CAD MO (Medium Opacity) blocks are suitable for the fabrication of frameworks with final veneering, whereas IPS e.max CAD LT (Low Translucency) blocks are used for fabricating fully anatomical crowns with optional cut-back and incisal layering.

#### Indications:

- Anterior and posterior crowns
- Partial crowns – Veneers

**Both glass ceramics allow natural shade effects to be reproduced and they enhance light transmission.**

#### The highlights

- Highly aesthetic lithium disilicate glass ceramic
- Lifelike aesthetics independent of the shade of the prepared tooth
- Adhesive and conventional cementation thanks to high strength of 360 to 400 MPa

# Zirconium oxide –

## All you need for high-strength restorations



### IPS e.max ZirCAD – Strength counts

For a long time, all-ceramic materials have been contraindicated for stress-bearing posterior bridges. Even though long-term study results are still scarce, zirconium oxide could at least partially replace metal-ceramics in the future. Zirconium oxide is the highest-performing all-ceramic material currently available for dental applications. Due to its high final strength, the material is also suitable for fabricating posterior bridges. In addition, zirconium oxide is characterized by excellent bio-compatibility and low thermal conductivity.

As a result of their high strength, IPS e.max ZirCAD bridges can be self-adhesively or conventionally cemented.

#### Indications:

- Crown frameworks for the anterior and posterior regions
- 3- to 6-unit bridge frameworks for the anterior and posterior regions
- Inlay-retained bridges
- Primary telescope crowns
- Implant superstructures (single tooth and bridge frameworks)



### IPS e.max ZirPress – Tried-and-tested press technology

As an alternative to conventionally veneering zirconium oxide frameworks, the press-on technique using fluorapatite glass-ceramic material can be used. Subsequently, the restorations can be either characterized with stains or complemented with veneering ceramic. With the press-on technique, crowns and bridges can be fabricated, which show an accuracy of fit comparable to that of pressed glass-ceramic restorations.

A further highlight is the minimally invasive all-ceramic inlay-retained bridge.

#### Indications:

- Veneers (without IPS e.max ZirCAD)
- In combination with IPS e.max ZirCAD*
  - For pressing onto IPS e.max ZirCAD single tooth copings
  - For pressing onto multi-unit IPS e.max ZirCAD bridge frameworks
  - For pressing onto IPS e.max ZirCAD inlay-retained bridge frameworks
  - For pressing onto implant superstructures made of IPS e.max ZirCAD (single tooth copings and bridge frameworks)
  - For pressing onto frameworks, implant abutments and implant superstructures made of sintered zirconium oxide and HIP zirconium oxide, which have a CTE in the range of  $10.5-11.0 \times 10^{-6} \text{ K}^{-1}$  (100-500 °C)

#### The highlights

- High-performance all-ceramic also for the posterior region thanks to the unrivalled strength and high fracture toughness
- Outstanding biocompatibility and low thermal conductivity
- Minimally invasive all-ceramic inlay bridges in conjunction with IPS e.max ZirPress



# Glass-ceramics –

## Preparation

### Basic rules

- Circular shoulder preparation with rounded inner edges or chamfer with a width of approx. 1 mm
- No feather edges
- Avoid sharp edges and angles
- Adhesive cementation protocols allow conservative cavity preparation
- Make sure to observe minimum layer thicknesses (stability of the restoration)

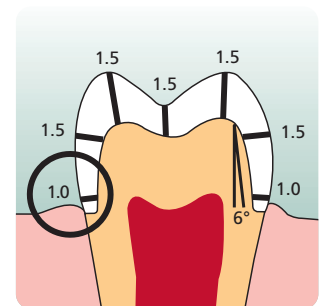
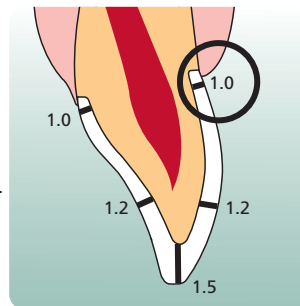
### Bridges (IPS e.max Press)

The maximum acceptable pontic width depends on the position, size and state of the teeth, as well as the position of the abutment within the tooth arch. The measurements to determine the bridge pontic width should be taken on the unprepared tooth.

- In the anterior region (up to the canine), the bridge pontic width should not exceed 11 mm.
- In the premolar region (from the canine up to the 2<sup>nd</sup> premolar), the bridge pontic width should not exceed 9 mm.

### Anterior and posterior crowns (IPS e.max Press | IPS e.max CAD)

Evenly reduce the anatomical shape and observe the stipulated minimum thicknesses. Prepare a circular shoulder with rounded inner edges or chamfer with an angle of approx. 10–30°. The width of the circular shoulder/chamfer is approx. 1 mm. Reduction of the crown third – incisal or occlusal areas – by approx. 2 mm. For anterior crowns, the labial and palatal/lingual part of the tooth should be reduced by approx. 1.5 mm.



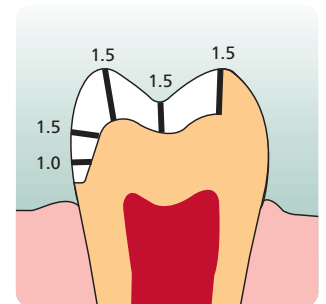
### IPS e.max CAD

The incisal edge of the preparation should be at least 1 mm (milling tool geometry) in order to permit optimum milling of the incisal edge during CAD/CAM processing.

A retentive tooth preparation design cannot be used if an adhesive luting technique is chosen.

### Partial crowns

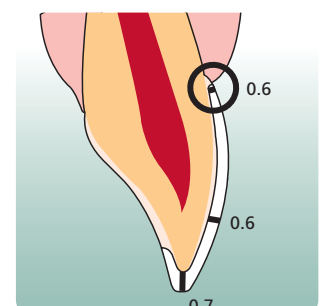
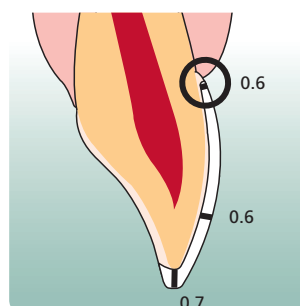
Provide at least 1.5 mm of space in the cusp areas. Partial crowns are indicated if the preparation margin is less than approx. 0.5 mm away from the cusp tip, or if the enamel is severely undermined. Prepare a circular shoulder with rounded inner edges or chamfer with an angle of approx. 20–30°. The width of the shoulder/chamfer is approx. 1.0 mm.



### Veneers

If possible, the preparation should be entirely located in the enamel. The incisal preparation margins should not be located in the area of the abrasion surfaces or dynamic occlusal surfaces. By preparing orientation grooves using a depth marker, controlled enamel reduction can be achieved. Opening of the proximal contacts is not required.

**Preparation without involving of the incisal edges (only labial reduction):** The preparation depth in the labial area should be at least 0.6 mm.



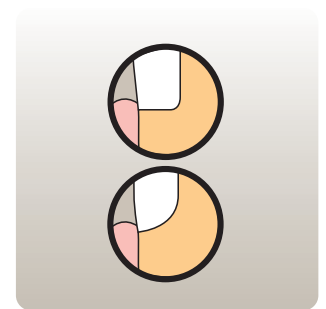
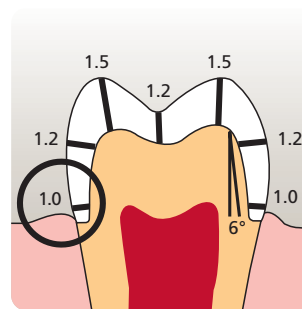
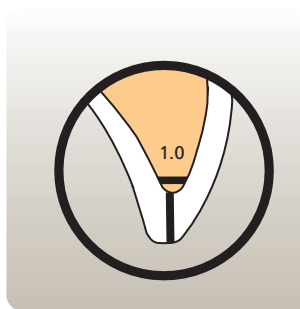
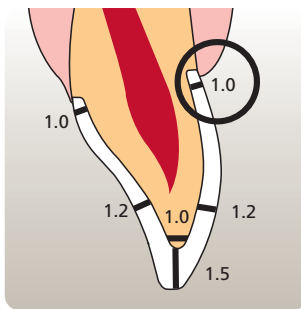
**Preparation reduction of the incisal edge (labial/incisal reduction):** The preparation depth in the cervical and labial area should be at least 0.6 mm. The incisal edge must be reduced by 0.7 mm. The more transparent the incisal edge of the intended veneer, the more pronounced the reduction should be.

# Zirconium oxide – Preparation

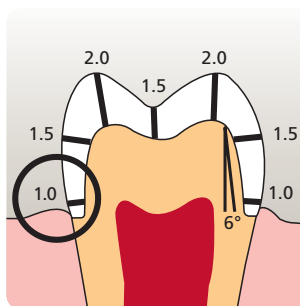
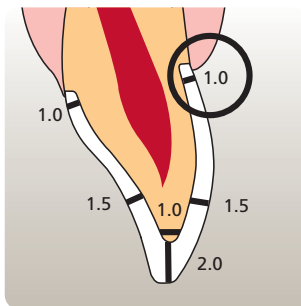
## Single crowns and up to 6-unit bridges

Evenly reduce the anatomical shape and observe the stipulated minimum thicknesses. Prepare a circular shoulder with rounded inner edges or chamfer. The width of the circular shoulder/ chamfer is approx. 1 mm. Reduce the crown third – incisal or occlusal areas – by approx. 1.2 mm. Reduce the incisal and occlusal areas by approx. 1.5 mm.

The incisal edge of the preparation should be at least 1 mm (milling tool geometry) in order to permit optimum milling of the incisal edge during CAD/CAM processing.



## Multi-unit bridges



Further information can be found in the corresponding literature.

# Practical procedure

## Shade determination

Selection of the correct shade based on the shade of the prepared tooth is an important prerequisite for restorative success. You should communicate both the shade of the preparation and the desired shade of the completed restoration to the dental technician. In this way, subsequent adjustments of the shade during cementation are avoided.

As the shade of the prepared tooth is defined, the dental technician is in a position to control the shade and brightness of the restoration during the individual working steps. The final shade is a combination of

- the shade of the prepared tooth
- the shade of the framework material
- the shade of the layering ceramic
- the shade of the luting material

The light curing IPS Natural Die Material encompasses 9 shades to imitate the shade of the prepared teeth. Among them are three new shades for bleached, intensively shaded and discoloured/devitalised teeth.



## Impression taking

Overall restorative success and the accuracy of fit of a restoration are essentially influenced by shade selection and impression taking/model casting procedures. The impression is taken as usual with either a silicone (e.g. Virtual®), polyether or any other suitable impression material using the impression technique preferred.

Bite record, e.g. with Virtual CADbite Registration, to incorporate antagonist data directly in the design of tooth restorations with CAD/CAM technology.



Impression taken of the preparation



## Temporary restoration

Provisional composite restorations made of eg Systemp®.c&b are the best solution if full crowns and bridges are fabricated.

The provisional restoration is cemented with a temporary, eugenol-free cement such as the dual-curing Systemp.link.

*Important: Do not use cements that contain eugenol, as these may detrimentally affect the curing process of the subsequently used luting composite!*



Provisional restoration (Systemp.c&b) with cement excess (Systemp.link) after incorporation. The provisional restoration can easily be removed.

## OptraDam® | OptraGate®

Modern dentistry would be unthinkable without the possibility of creating a completely dry field using rubber dam isolation. Due to its anatomical shape and the three-dimensional flexibility, OptraDam is very comfortable to wear for patients even during long treatment sessions. OptraGate provides effective perioral retraction of the lips and cheeks and thus considerably enlarges the operating field. As a result, visibility and accessibility are significantly increased. The material of the successor version OptraGate "ExtraSoft" has been optimized to further enhance patient comfort to provide a snug but gentle fit.



Complete isolation of the treatment field using OptraDam is recommended when restorations are adhesively cemented.



OptraGate provides easy access to an enlarged treatment field.

# Cementation options

The use of aesthetic luting cements is crucial to ensuring harmonious shading of metal-free restorations. IPS e.max all-ceramic restorations can also be self-adhesively or conventionally cemented, depending on the indication.

For the conventional cementation of IPS e.max restorations, we recommend using Vivaglass CEM glass ionomer cement. Powder-liquid systems are used for self-adhesive cementation. Variolink II, Variolink Veneer or Multilink Automix are the ideal composites when the adhesive luting technique is chosen.



|                                          |                                                                         | Cementation                                           |                               |
|------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------|-------------------------------|
|                                          |                                                                         | adhesive                                              | self-adhesive* / conventional |
| IPS e.max Press                          | Thin veneers, veneers                                                   | ✓                                                     | –                             |
|                                          | Partial crowns                                                          | ✓                                                     | –                             |
|                                          | Anterior and posterior crowns, 3-unit bridges up to the second premolar | ✓                                                     | ✓                             |
|                                          |                                                                         |                                                       |                               |
| IPS e.max ZirPress                       | Veneers                                                                 | ✓                                                     | –                             |
| IPS e.max ZirCAD +<br>IPS e.max ZirPress | Inlay-retained bridges                                                  | ✓                                                     | –                             |
| IPS e.max ZirCAD                         | Crowns and bridges                                                      | ✓                                                     | ✓                             |
| IPS e.max CAD                            | Veneers                                                                 | ✓                                                     | –                             |
|                                          | Partial crowns                                                          | ✓                                                     | –                             |
|                                          | Anterior and posterior crowns                                           | ✓                                                     | ✓                             |
| IPS e.max Ceram                          | Veneers                                                                 | ✓                                                     | –                             |
| Recommended cementation materials        |                                                                         | Variolink II<br>Variolink Veneer<br>Multilink Automix | Vivaglass CEM                 |

- ✓ recommended product combination
- not recommended/product combination not possible
- \* self-adhesive powder-liquid systems

### The Variolink® line of products ...

... comprises time-tested adhesive luting composites, ensuring high-quality cementation results in conjunction with indirect metal-free restorations.



The classic **Variolink II** is generally recommended for light- and dual-curing cementation procedures. It is available in six shades and two consistencies.



The water-soluble **Variolink II Try-In** pastes allow the shade of permanently placed restorations to be simulated prior to their cementation.



**Variolink Ultra** is particularly suitable for use in conjunction with ultrasonic procedures and only differs from Variolink II in that it has a higher viscosity.

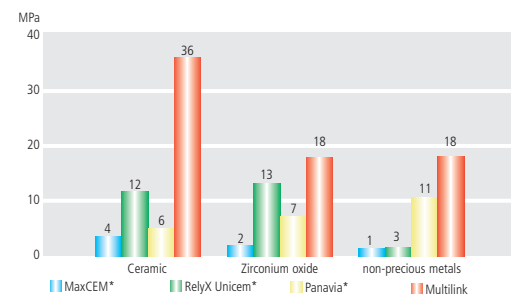
The new, solely light-curing **Variolink Veneer** features a new shade concept and is based on new filler technology. It achieves enhanced shade and translucency, in particular when cementing highly aesthetic restorations in the anterior region.



The Variolink assortments are available with different adhesive agents.

### Multilink® Automix

... is a self-curing (chemically curing), self-etching luting composite system. It is suitable for universal applications and is offered in the practical double syringe. Multilink offers all the advantages of adhesive cements and shows superior adhesive strength. The application of several components (primer, bonding agent) required by other self-etching products, is eliminated.



Source: Dr. Carlos Munoz, Suny Buffalo  
\*Not registered trademarks of Ivoclar Vivadent AG

### Vivaglass® CEM ...

... is a universal, self-curing glass ionomer cement for conventional cementation which demonstrates excellent bonding values. Its high translucency enables you to achieve aesthetic results, eg in case of exposed ceramic shoulders.



# Preparing the restorations for cementation

## Glass-ceramics

**Which restorations should be etched, blasted with aluminium oxide or silanated prior to insertion?**

**This depends on the material!**

|                                    | IPS e.max Press                                                                                                                       |                             | IPS e.max CAD                                                                      |                             | IPS e.max Ceram                     |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------------------------------------------------------------------------------------|-----------------------------|-------------------------------------|
| <b>Materials</b>                   | Lithium disilicate                                                                                                                    |                             | Lithium disilicate                                                                 |                             | Glass-ceramics                      |
| <b>Indication</b>                  | Veneers <sup>2)</sup> , partial crowns <sup>2)</sup> , anterior + posterior crowns, 3-unit bridges up to the 2 <sup>nd</sup> premolar |                             | Veneers <sup>2)</sup> , partial crowns <sup>2)</sup> , anterior + posterior crowns |                             | Veneers <sup>2)</sup>               |
| <b>Cementation method</b>          | adhesive                                                                                                                              | self-adhesive*/conventional | adhesive                                                                           | self-adhesive*/conventional | adhesive                            |
|                                    | ✓                                                                                                                                     | ✓                           | ✓                                                                                  | ✓                           | ✓                                   |
| <b>Etching</b>                     | 20 sec with IPS Ceramic Etching Gel                                                                                                   |                             | 20 sec with IPS Ceramic Etching Gel                                                |                             | 20 sec with IPS Ceramic Etching Gel |
| <b>Conditioning / Silanization</b> | 60 sec with Monobond-S                                                                                                                | – <sup>1)</sup>             | 60 sec with Monobond-S                                                             | – <sup>1)</sup>             | 60 sec with Monobond-S              |
| <b>Cementation system</b>          | Variolink® Veneer<br>Variolink® II<br>Multilink® Automix                                                                              | Vivaglass® CEM              | Variolink® Veneer<br>Variolink® II<br>Multilink® Automix                           | Vivaglass® CEM              | Variolink® Veneer<br>Variolink® II  |

<sup>1)</sup> For self-adhesive cementation, silanization is necessary.

<sup>2)</sup> Partial crowns and veneers must be adhesively cemented

\* self-adhesive powder-liquid systems



Please observe the corresponding Instructions for Use

**If an adhesive cementation protocol is applied, glass-ceramic materials** are normally etched with the hydrofluoric acid IPS Ceramic Etching Gel and subsequently silanated using the silane Monobond-S.

**Important:** Glass-ceramic material must **not** be sandblasted!



**High-strength glass-ceramics (IPS e.max Press, IPS e.max CAD)** can also be conventionally cemented using glass ionomer cements. Silanization is not required for conventional cementation with glass ionomer cements.

# Zirconium oxide

| Materials                   | IPS e.max ZirCAD – IPS e.max ZirPress    |                             |                                           |                                    | IPS e.max ZirCAD – IPS e.max Ceram |                             |
|-----------------------------|------------------------------------------|-----------------------------|-------------------------------------------|------------------------------------|------------------------------------|-----------------------------|
|                             | Zirconium oxide                          |                             | Glass-ceramics pressed on zirconium oxide | Glass-ceramics                     | Zirconium oxide                    |                             |
| Indication                  | Crowns +bridges w./w.o. pressed shoulder |                             | Inlay-retained bridges                    | Veneers <sup>2)</sup>              | Crowns + bridges                   |                             |
| Cementation method          | adhesive                                 | self-adhesive*/conventional | adhesive                                  | adhesive                           | adhesive                           | self-adhesive*/conventional |
|                             | ✓                                        | ✓                           | ✓                                         | ✓                                  | ✓                                  | ✓                           |
| Etching                     | —                                        |                             | 20 sec with IPS Ceramic Etching Gel       |                                    | —                                  |                             |
| Conditioning / Silanization | 180 sec with Metal/Zirconia Primer       | —                           | 60 sec with Monbond-S                     |                                    | 180 sec with Metal/Zirconia Primer | —                           |
| Cementation system          | Multilink® Automix                       | Vivaglass® CEM              | Multilink® Automix                        | Variolink® Veneer<br>Variolink® II | Multilink® Automix                 | Vivaglass® CEM              |

<sup>2)</sup> Veneers must be adhesively cemented

\* self-adhesive powder-liquid systems



Please observe the corresponding Instructions for Use

**Zirconium oxide-based restorations** are neither etched nor silanated. The inner aspect of the restoration can be cleaned by sandblasting it with 110 µm aluminium oxide at 1 bar pressure. To establish an adhesive bond, we recommend to use the Metal/Zirconia Primer. Zirconium oxide restorations can also be conventionally cemented using glass ionomer cements.







# IPS e.max Press | Ceram crown adhesively cemented with Variolink II | Syntac

Clinical case: Courtesy of Prof Dr Daniel Edelhoff / Oliver Brix, Germany

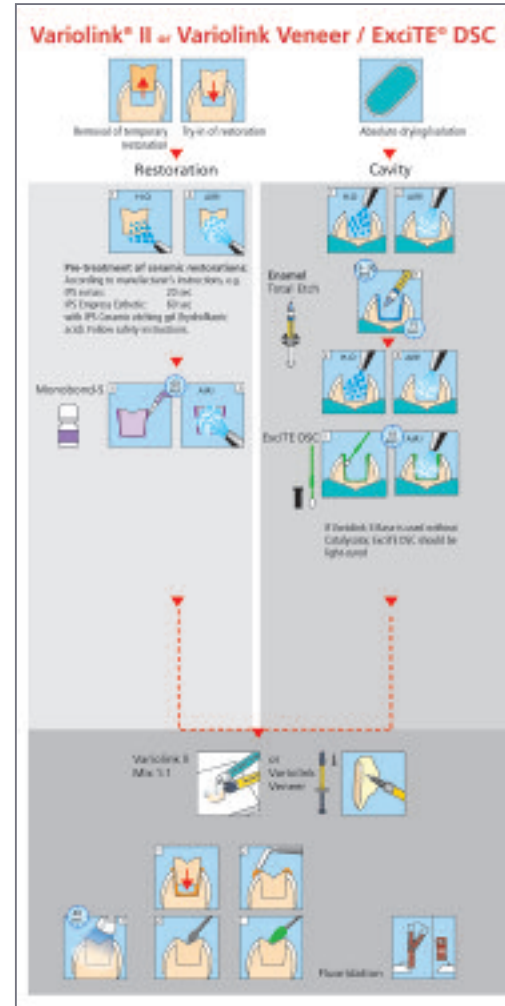
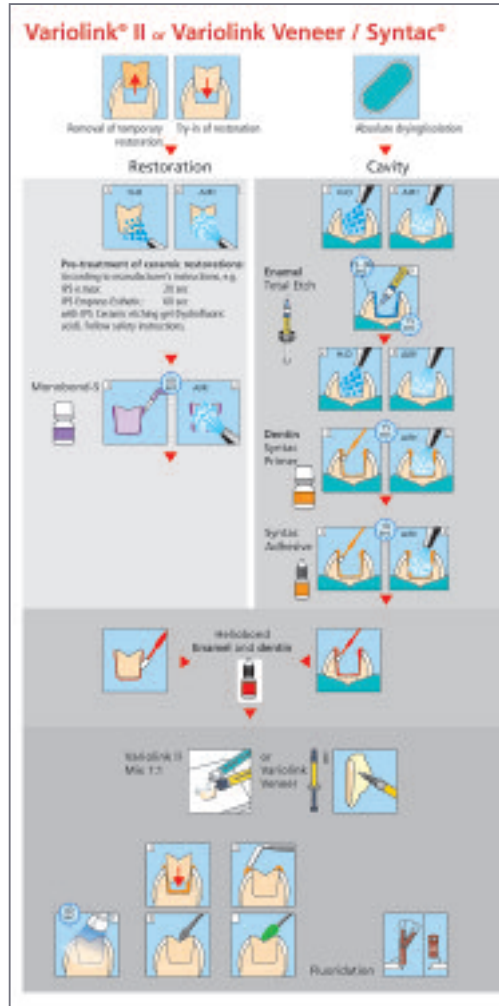
Depending on the dentin adhesive used, system-specific procedures are applied.

**Syntac** is a time-tested multi-component adhesive system. An adhesive bond to dentin and enamel is established by consecutively applying Syntac Primer, Syntac Adhesive and Heliobond.

**Excite DSC** is a dual-curing single-component adhesive with an innovative applicator.



Preoperative situation: Fractured tooth





Tooth preparation for a glass-ceramic crown. The tooth is prepared for adhesive cementation.



Adhesive cementation of the crown involves the following steps:

**Conditioning of the restoration:**

- Rinse the restoration with water and blow dry with an air syringe.
- Important: Glass-ceramic materials must not be sandblasted!*
- Etch the inner aspects of the restoration with the hydro-fluoric acid IPS Ceramic Etching Gel for 20 seconds, thoroughly rinse with water and blow dry with the air syringe.



- Apply the silane Monobond-S to the inner aspects of the restoration for 60 seconds and air-dry.
- Subsequently, apply a thin coat of Heliobond and protect from light until the restoration is seated.



**Conditioning of the preparation:**

- Rinse the preparation with water and blow dry with the air syringe.
- Etch the enamel with phosphoric acid gel (eg Total Etch) for 30 seconds. If required, etch the dentin surfaces for 10–15 seconds. Thoroughly rinse off phosphoric acid using water spray and blow dry with the air syringe.
- Apply a dentin bonding agent, eg Syntac dentin/enamel bonding system
  - Let Syntac Primer react on the dentin for 15 seconds. Then thoroughly dry with the air syringe.
  - Let Syntac Adhesive react on the dentin for 10 seconds and dry with the air syringe.
- Coat enamel and dentin surfaces with Heliobond using a brush and remove excess with water spray/blow off with the air syringe.



*Important: Do not polymerize Heliobond, as this could detrimentally affect the fit of the restoration.*



#### **Seating of the restoration:**

- Apply ready-mixed Variolink II luting composite to the inner surfaces of the restoration and/or to the prepared tooth if required (to avoid air entrapments). Seat the restoration.
- Remove gross excess using foam pellets and dental floss.
- Cover margins with glycerine gel (Liquid Strip) to prevent oxygen inhibition.
- Polymerize the seated crown from all aspects using a curing light (eg bluephase® – HIP mode).

#### **Finishing and polishing:**

- Occlusal adjustments are performed using fine diamonds (30 micron).
- Polishing is carried out with ceramic polishing sets (eg diamond-coated ceramic polishers from Brasseler)
- After removing all excess, fluoridize the tooth with eg Fluor Protector.

The completed **IPS e.max Press** | **Ceram** crown in place



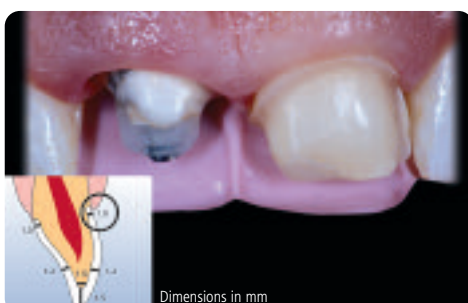
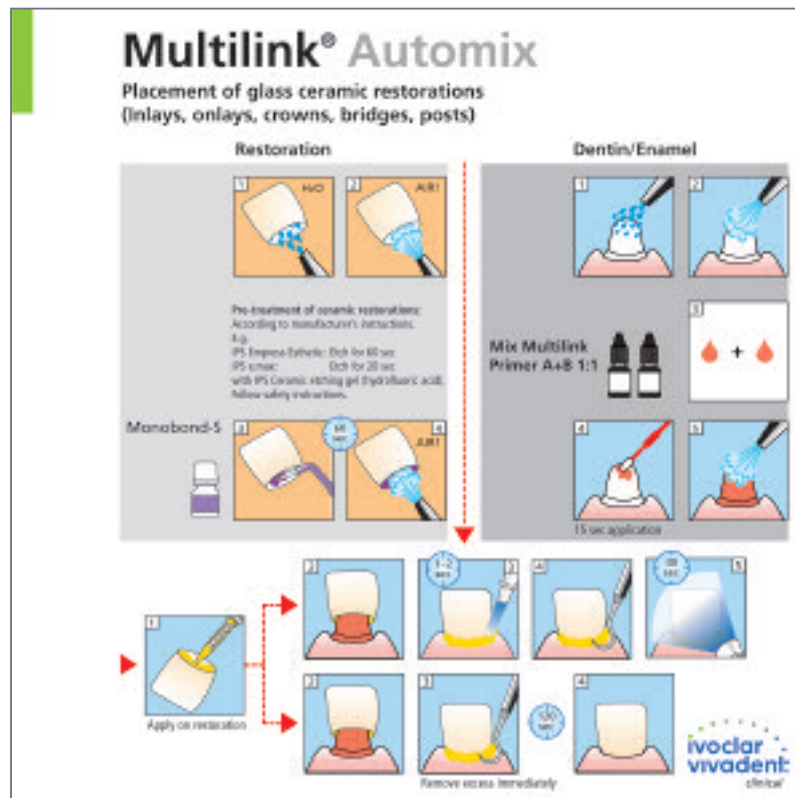
Pictures courtesy of Prof. Dr Daniel Edelhoff / Oliver Brix, Germany



*Clinical case: Courtesy of Dr. Dr. Andreas Rathke | Achim Kuster, Liechtenstein*



Preoperative situation: Fractured tooth  
After a sports accident, tooth 11 had been restored with a metal-ceramic crown, while the incisal edge of tooth 21 had been reconstructed with a composite build-up.



Preparation of tooth 11 for an IPS e.max CAD crown and of tooth 21 for an IPS e.max Ceram veneer. A considerable difference is observable as regards the amount of tooth structure that had been removed. While the margins of the crown preparation had to be located in dentin, those of the veneer preparation could be located in enamel.



After milling the IPS e.max CAD MO blocks (in eg the inLab® system from Sirona or Everest® system from KaVo), the crystallization process is conducted in a ceramic furnace. The framework obtains its natural shade through the crystallization process.

The tooth-coloured framework is subsequently veneered with IPS e.max Ceram layering ceramic.

inLab® is a registered trade mark of Sirona Dental Systems GmbH  
Everest® is a registered trademark of KaVo Dental GmbH

The adhesive cementation of the crowns involves the following steps:



#### Conditioning of the preparation:

- Remove the provisional restoration and clean the cavity. Mix Multilink Primer A+B in a 1:1 ratio and apply it to the dentin and enamel surfaces, scrubbing with slight pressure for 15 seconds. A reaction time of 30 seconds is recommended on the enamel, and 15 seconds on dentin. The applied primer is subsequently dried with water- and oil-free air. As the Primer is solely self-curing, no light curing is necessary!



#### Conditioning of the restoration:

- Rinse restoration with water and blow dry with the air syringe.  
*Important: Glass-ceramic materials must not be sandblasted!*
- Pre-treatment of the crown: Etch inner surfaces with the hydrofluoric acid IPS Ceramic Etching Gel for 20 seconds, thoroughly rinse with water and blow dry with the air syringe.



- Apply the silane Monobond-S to all inner surfaces for 60 seconds and air-dry.



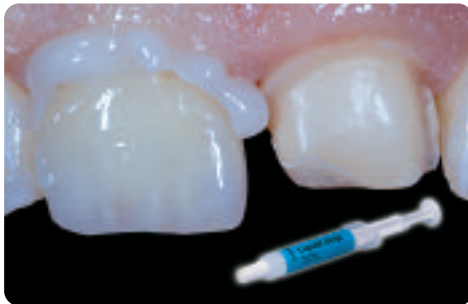


#### Seating of the restoration:

Apply the desired amount of Multilink Automix from the automix syringe directly on the inner aspects of the restoration. Seat the restoration.

#### *Seating of the restoration - solely self-curing:*

Remove excess material immediately with a microbrush/brush/foam pellet/dental floss or scaler. Make sure to remove excess in time in difficult-to-reach areas. Due to the reaction between Multilink Automix and Multilink Primer A/B, a high bond strength and degree of cure is achieved quickly after the placement of the restoration.



#### *Seating of the restoration - self-curing with optional light curing:*

Cure excess material briefly with light (1–2 seconds) which enables a smooth removal by using a scaler. Make sure to remove excess in time in difficult-to-reach areas. Subsequently, light cure all cement margins for 20 seconds.

Coat the margins with glycerine gel (Liquid Strip) to prevent oxygen inhibition. Rinse off the gel after complete polymerization.

#### Finishing and polishing:

- Occlusal adjustments are performed using fine diamonds (30 micron).
- Polishing is carried out with ceramic polishing sets (e.g. diamond-coated ceramic polishers from Brasseler).
- After removing all excess, fluoridize the tooth with e.g. Fluor Protector.

The completed **IPS e.max CAD** | **Ceram** restoration in place



Left: IPS e.max CAD/Ceram crown; Right: IPS e.max veneer  
As the same veneering ceramic was used for both restorations, a consistent optical appearance is achieved.

Pictures courtesy of Dr Dr Andreas Rathke / Achim Kuster, Liechtenstein

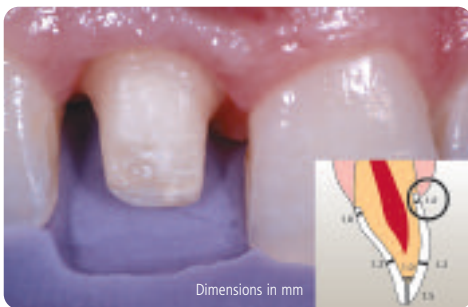


# IPS e.max ZirCAD | Ceram crown conventionally cemented with Vivaglass CEM

*Clinical case: courtesy of Dr Dr Andreas Rathke / Achim Kuster, Liechtenstein*



Preoperative situation

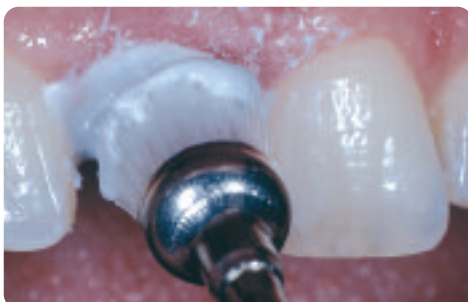


IPS e.max ZirCAD crown preparation, performed with the help of a silicone matrix



The IPS e.max ZirCAD blocks are processed in the inLab system from Sirona in a partially sintered, "chalk-like" state. The milled framework is subsequently sintered in the Sintramat high temperature furnace.

Following this, either IPS e.max ZirPress is pressed onto the crown coping and/or the crown coping is veneered using IPS e.max Ceram layering ceramic.



## **Conditioning of the preparation:**

Clean preparation with prophy paste, eg Proxylt®, rinse with water and blow dry with the air syringe. Avoid overdrying of the dentin surfaces!



**Conditioning of the restoration:**

The inner surfaces of the zirconium oxide restoration can be blasted with 110 µm aluminium oxide at 1 bar pressure prior to insertion.



**Seating of the restoration:**

- Mix one drop of liquid and one scoop of powder on the mixing pad.
- Subsequently, load the blasted crown with translucent Vivaglass CEM glass ionomer cement and seat it exerting slight pressure.
- Remove excess cement immediately afterwards.

**Finishing and polishing:**

- Occlusal adjustments are performed using fine diamonds (30 micron)
- Polishing is carried out with ceramic polishing sets (eg diamond-coated ceramic polishers from Brasseler)
- After removing all excess, fluoridize the tooth with eg Fluor Protector.

The completed IPS e.max ZirCAD | Ceram crown in place ...



... blends harmoniously into the natural surroundings.



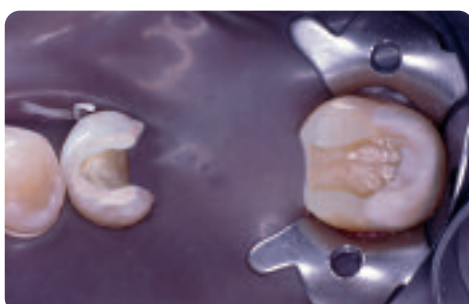
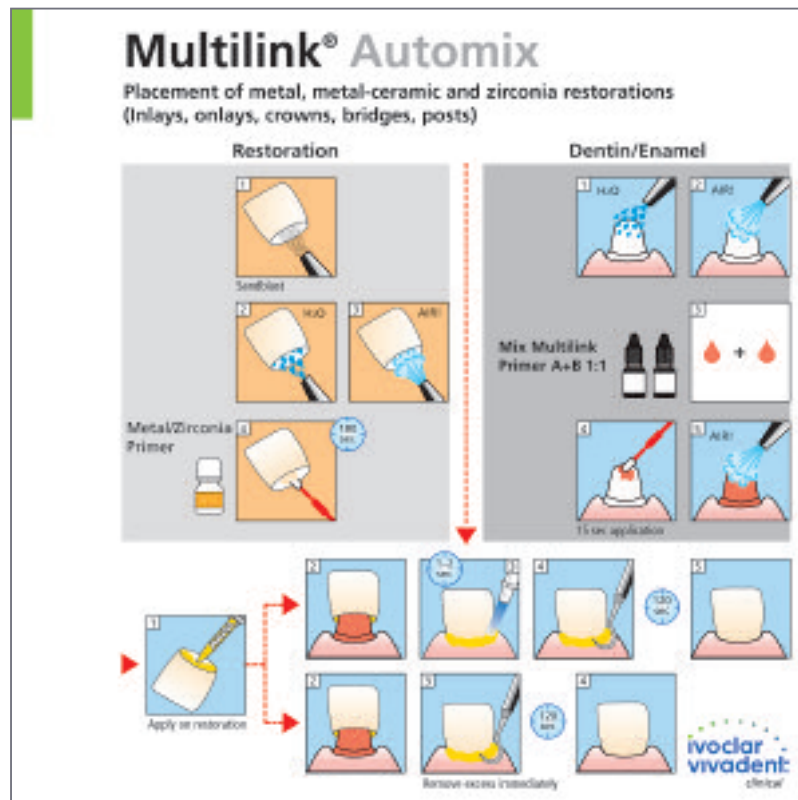


# IPS e.max ZirCAD | ZirPress inlay-retained bridge adhesively cemented with Multilink Automix

Clinical case: Courtesy of Prof. Dr. Daniel Edelhoff | Oliver Brix, Germany



Preoperative situation



Preparation for an inlay-retained bridge



**Conditioning of the preparation:**

- Remove the provisional restoration and clean the cavity.
- Mix Multilink Primer A+B in a 1:1 ratio and apply to the dentin and enamel surfaces, scrubbing with slight pressure for 15 seconds. A reaction time of 30 seconds is recommended on the enamel, and 15 seconds on dentin. The applied primer is subsequently dried with water- and oil-free air.

As the Primer is solely self-curing, no light curing is necessary!



**Conditioning of the restoration:**

- Rinse restoration with water and blow dry with the air syringe.
- *Important: The IPS e.max ZirCAD/ZirPress inlay bridge must not be sandblasted!*



- Etch inner surfaces with the hydrofluoric acid IPS Ceramic Etching Gel for 20 seconds, thoroughly rinse with water and blow dry with the air syringe.



- Apply the silane Monobond-S to all inner surfaces for 60 seconds and air-dry.



#### **Seating of the restoration:**

Apply the desired amount of Multilink Automix from the automix syringe directly on the inner aspects of the restoration. Seat the restoration.

#### *Seating of the restoration - solely self-curing:*

Remove excess material immediately with a microbrush/brush/foam pellet/dental floss or scaler. Make sure to remove excess in time in difficult-to-reach areas. Due to the reaction between Multilink Automix and Multilink Primer A/B, a high bond strength and degree of cure is achieved quickly after the placement of the restoration.

#### *Seating of the restoration - self-curing with optional light curing:*

Cure excess material briefly with light (1–2 seconds) which enables a smooth removal by using a scaler. Make sure to remove excess in time in difficult-to-reach areas. Subsequently, light cure all cement margins for 20 seconds.

Coat the margins with glycerine gel (Liquid Strip) to prevent oxygen inhibition. Rinse off the gel after complete polymerization.

#### **Finishing and polishing:**

- Occlusal adjustments are performed using fine diamonds (30 micron).
- Polishing is carried out with ceramic polishing sets (e.g. diamond-coated ceramic polishers from Brasseler).
- After removing all excess, fluoridize the tooth with e.g. Fluor Protector.

## IPS e.max ZirCAD | ZirPress inlay-retained bridge ...



... adhesively cemented with Multilink.

Pictures courtesy of PD Dr Daniel Edelhoff / Oliver Brix, Germany

*Prof. Dr. Daniel Edelhoff | Oliver Brix, Germany*



**Complete restoration of both dental arches with IPS e.max**  
Adhesive cementation in the anterior region using Variolink Veneer, and Multilink Automix in the posterior region.

*PD Dr. Daniel Edelhoff | Oliver Brix, Germany*



**IPS e.max ZirCAD/IPS e.max Ceram**  
The zirconium oxide copings were veneered with IPS e.max Ceram and conventionally cemented.

*Dr. Andreas Kurbad | Kurt Reichel, Germany*



**IPS e.max CAD/IPS e.max Ceram**  
The copings milled from IPS e.max CAD lithium disilicate glass-ceramic blocks were veneered with IPS e.max Ceram and cemented with Multilink Automix.



*Dr. Holger Gleixner, Germany | Jürgen Seger, Liechtenstein*



**IPS e.max Press/CAD/ZirCAD/ZirPress and IPS e.max Ceram**

Copings and bridge frameworks made of IPS e.max CAD/Press/ZirCAD and ZirPress characterized and veneered with IPS e.max Ceram. The glass-ceramic restorations made of IPS e.max CAD and Press were cemented with Variolink II, while for the IPS e.max ZirCAD bridges Multilink Automix was used.

*Prof. Sidney Kina, Brazil | August Bruguera, Spain*



**IPS e.max Press and IPS e.max Ceram**

Lithium disilicate glass-ceramic copings made of IPS e.max Press were veneered with IPS e.max Ceram and conventionally cemented.

*Dr. Klaus Hoederath | Volker Brosch, Germany*



**IPS e.max CAD and IPS e.max Ceram**

Adhesively cemented restorations made of IPS e.max CAD lithium disilicate glass-ceramic and veneered with IPS e.max Ceram.

*Dr. Andreas Kurbad | Kurt Reichel, Germany*



**IPS e.max CAD and IPS e.max Ceram**

The restorations milled from IPS e.max CAD were layered with IPS e.max Ceram in the incisal area using the cut-back technique and subsequently self-adhesively cemented.

*Dr. Sidney Kina, Brazil | Gérald Ubassy, France*



**IPS e.max Press and IPS e.max Ceram**

The lithium disilicate glass-ceramic veneers made of IPS e.max Press were layered in the incisal area with IPS e.max Ceram and adhesively cemented using Variolink Veneer.

*Dr. Sidney Kina, Brazil | August Bruguera, Spain*



**IPS e.max Press and IPS e.max Ceram**

IPS e.max Press crowns veneered with IPS e.max Ceram and adhesively cemented



*Dr. Galip Gürel, Turkey | Shigeo Kataoka, Japan*



**IPS e.max Press and IPS e.max Ceram**

IPS e.max Press veneers and crowns were veneered with IPS e.max Ceram and adhesively cemented using Variolink Veneer.

*Dr. Kohei Ogura | Shoji Sasaki, Japan*



**IPS e.max Press and IPS e.max Ceram**

IPS e.max Press crowns veneered with IPS e.max Ceram and adhesively cemented

*Dr. A. Kurbad | Kurt Reichel, Germany*



**IPS e.max CAD and IPS e.max Ceram**

The crowns milled from IPS e.max CAD were layered with IPS e.max Ceram in the incisal area and subsequently self-adhesively cemented.



### 1. Head of study:

*Prof Dr Mörmann, University of Zurich, Switzerland*

|               |                                                                                                                                                     |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Title:        | Clinical performance of Cerec crowns made of lithium disilicate glass-ceramic                                                                       |
| Objective:    | To examine the clinical performance of CAD/CAM-manufactured lithium disilicate crowns                                                               |
| Experimental: | A total of 45 IPS e.max CAD crowns were fabricated. They were either adhesively luted with Multilink or conventionally cemented with Vivaglass CEM. |
| Start:        | January 2004                                                                                                                                        |
| Results:      | IPS e.max CAD crowns can also be conventionally cemented.                                                                                           |

### 2. Head of study:

*Prof Nathanson, Boston University, USA*

|               |                                                                                       |
|---------------|---------------------------------------------------------------------------------------|
| Title:        | Clinical performance of IPS e.max CAD crowns veneered with IPS e.max Ceram            |
| Objective:    | To examine the clinical performance of CAD/CAM-manufactured lithium disilicate crowns |
| Experimental: | Forty crowns made of IPS e.max CAD and veneered with IPS e.max Ceram were placed.     |
| Start:        | July 2004                                                                             |
| Results:      | No failures, eg fractures, have occurred.                                             |

### 3. Head of study:

*PD Dr Edelhoff, University Clinic Aachen, Germany*

|               |                                                                                                                                                                                                                                                                            |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Title:        | Clinical performance of IPS e.max Press veneered with IPS Eris for E2                                                                                                                                                                                                      |
| Objective:    | To examine the clinical performance of IPS e.max Press restorations                                                                                                                                                                                                        |
| Experimental: | A total of 139 restorations (121 crowns, 18 bridges) were incorporated in 52 patients. The majority of the restorations were cemented in place using an adhesive technique (Variolink II) and a few restorations were placed using a glass ionomer cement (Vivaglass CEM). |
| Start:        | September 2003                                                                                                                                                                                                                                                             |
| Results:      | No failures were reported after a mean observation period of 13.84 months (1 to 23 months). Neither framework fractures nor chipping of veneering material occurred.                                                                                                       |

### 4. Head of study:

*Dr Stappert, University Clinic, Freiburg i Br, Germany*

|               |                                                                                                                                                                                                                         |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Title:        | Clinical evaluation of partial lower posterior crowns fabricated using an all-ceramic lithium disilicate or using the CEREC 3 technique                                                                                 |
| Objective:    | To evaluate the clinical performance of all-ceramic partial crowns for the posterior region (IPS e.max Press and ProCAD)                                                                                                |
| Experimental: | Crowns/inlays made of IPS e.max Press (n=40) and ProCAD (n=40) were placed. A maximum of 20 non-vital abutment teeth were included in each group. The aim was to stabilize these teeth with an all-ceramic post system. |
| Start:        | 2003                                                                                                                                                                                                                    |
| Results:      | Both groups have not produced any failures one year into the study.                                                                                                                                                     |

### 5. Head of study:

*Prof Stanford, Dental Clinical Research Center, University of Iowa, USA*

|               |                                                                                                                               |
|---------------|-------------------------------------------------------------------------------------------------------------------------------|
| Title:        | Clinical long-term performance of IPS e.max Ceram on IPS e.max ZirCAD                                                         |
| Objective:    | To evaluate the clinical long-term performance of IPS e.max Ceram on restorations made of ZirCAD.                             |
| Experimental: | Incorporation of 40 crowns and 10 bridges made of IPS e.max ZirCAD veneered with IPS e.max Ceram                              |
| Start:        | September 2004                                                                                                                |
| Results:      | Neither framework fractures nor chipping of veneering material was observed after all the restorations had been incorporated. |

### 6. Head of study:

*Prof Sorensen, Pacific Dental Institute, Portland, USA*

|               |                                                                                                                                 |
|---------------|---------------------------------------------------------------------------------------------------------------------------------|
| Title:        | Long-term clinical performance of IPS e.max Ceram on IPS e.max ZirCAD                                                           |
| Objective:    | To evaluate the long-term clinical performance of IPS e.max Ceram on bridges made of IPS e.max ZirCAD                           |
| Experimental: | Incorporation of 20 bridges made of IPS e.max ZirCAD veneered with IPS e.max Ceram                                              |
| Start:        | December 2004                                                                                                                   |
| Results:      | During the observation period of more than 6 months neither framework fractures nor chipping of veneering ceramic was observed. |



#### 7. Head of study:

*Prof Fasbinder, University of Michigan, Ann Arbor, USA*

|               |                                                                                                                                                                      |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Title:        | Clinical performance of IPS e.max Ceram on IPS e.max ZirPress and IPS e.max ZirCAD                                                                                   |
| Objective:    | To examine the clinical performance of IPS e.max ZirCAD. One half of the frameworks was veneered with IPS e.max Ceram, while ZirPress was pressed on the other half. |
| Experimental: | Thirty crowns and 10 bridges made of IPS e.max ZirCAD/IPS e.max ZirPress/IPS e.max Ceram were placed.                                                                |
| Start:        | January 2005                                                                                                                                                         |
| Results:      | Neither framework fractures nor chipping of the veneering material was observed after all the restorations had been incorporated.                                    |

#### 8. Head of study:

*Dr. Beuer (Prof. Gernet), University Clinic, Munich, Germany*

|               |                                                                                                                          |
|---------------|--------------------------------------------------------------------------------------------------------------------------|
| Title:        | Clinical study on all-ceramic restorations made of zirconium oxide ceramic veneered with a new veneering ceramic         |
| Objective:    | To examine the clinical performance of IPS e.max ZirCAD as a framework material for crowns and bridges                   |
| Experimental: | Incorporation of 20 crowns and 20 bridges (3 to 4 units) made of zirconium oxide (Y-TZP), veneered with IPS e.max Ceram. |
| Start:        | May 2004                                                                                                                 |
| Results:      | After the restorations had been observed up to one year, chipping of veneering material was recorded in one case.        |

#### 9. Head of study:

*Prof Rammelsberg, University Clinic, Heidelberg, Germany*

|               |                                                                                                                                                                                                                                                                  |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Title:        | Clinical study on all-ceramic, zirconium oxide-based inlay-retained bridges manufactured using a CAD/CAM technique                                                                                                                                               |
| Objective:    | To examine the clinical performance of IPS e.max ZirCAD-based inlay-retained bridges                                                                                                                                                                             |
| Experimental: | Thirty inlay-retained bridges were incorporated; each bridge included at least one inlay as bridge anchor. The frameworks were made of zirconium oxide onto which IPS e.max ZirPress was pressed. The resultant restorations were veneered with IPS e.max Ceram. |
| Start:        | October 2004                                                                                                                                                                                                                                                     |
| Results:      | Neither framework fractures nor chipping of the veneering material has been reported to date.                                                                                                                                                                    |

#### 10. Head of study:

*Dr Tinschert, University Clinic, Aachen, Germany*

|               |                                                                                                                                                                                                                                           |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Title:        | Prospective clinical study on the survival rate of posterior zirconium oxide-reinforced crowns manufactured using the press-on technique                                                                                                  |
| Objective:    | To examine the clinical performance of IPS e.max ZirCAD-based molar crowns                                                                                                                                                                |
| Experimental: | Thirty posterior crowns comprising zirconium oxide copings made of DC Zirkon, Lava and IPS e.max ZirCAD were incorporated. IPS e.max ZirPress was pressed onto the copings. Subsequently, the copings were veneered with IPS e.max Ceram. |
| Start:        | October 2004                                                                                                                                                                                                                              |
| Results:      | Neither framework fractures nor chipping of the veneering material has been reported to date.                                                                                                                                             |

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# Ivoclar Vivadent – worldwide

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