REFLECT

dental people for dental people 03/09

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Editorial

Dear Reader

Especially in economically challenging times such as these, we look to the Asia-Pacific region and its emerging economies as potential growth markets. With an average GDP increase of about 5 %, the economies in Asia and the Pacific grew faster than any other major economy in the world in 2007 and 2008.

China, for example, still managed to grow its GDP by 9 % in 2008. Despite the ongoing global economic crisis, its GDP is expected to continue to grow by 6.5 % in 2009.
This economic growth also triggers growth in demand for dental products and services.

Asia Pacific cannot be approached as one homogeneous market, however, because the economic conditions are quite varied in the different countries. On the one hand, we have mature markets such as Japan, South Korea, Australia, New Zealand and Singapore which face economic woes similar to those in the US and Europe. On the other, there are emerging markets such as India, Thailand and China (to name just a few) with a growing economy and a new, expanding middle class.

At Ivoclar Vivadent we believe that due to these differences, it is essential to provide quality dental products and services that are tailored to local needs. Consequently, we are increasingly focusing on the individual markets by investing in the local infrastructure, employing additional staff, collaborating on local research projects and, last but not least, by adding new or enlarging existing ICDEs.

We now have offices in Mumbai, Singapore, Shanghai, Tokyo, Melbourne, Brisbane, Sydney, Perth, Auckland, Wellington and Christchurch and dedicated Ivoclar Vivadent staff in most countries throughout the region. With strong support from our dealer network and the innovative strength of our head office, these measures have increased our ability to service our customers and provide them with highly esthetic, excellent dental materials that provide enhanced productivity and better solutions for their patients.

Based on our long-term commitment we are uniquely well positioned to participate in the continuing growth of dental services in the Asia-Pacific region.

We hope that you will enjoy reading this issue of Reflect.

Sincerely

Christian Brutzer
Director Sales Asia Pacific

The front cover shows a long-span zirconium oxide framework on a Programat S1 sintering tray (Photo: Nicole Schweizer).

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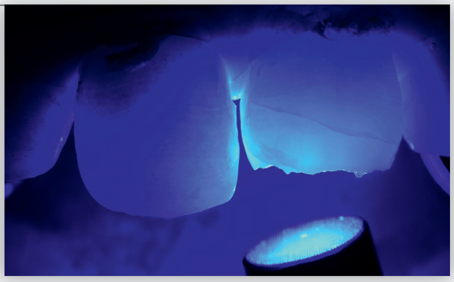
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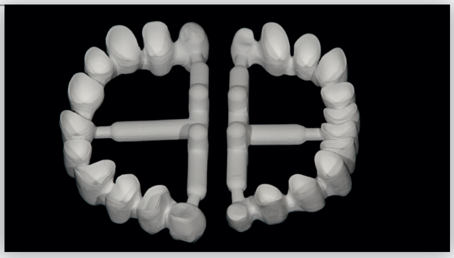
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Opalescent composite resin

A case report on the restoration of teeth with highly esthetic composite materials

Dentist Ulf Krueger-Janson, Frankfurt am Main/Germany

Experience has shown that esthetically pleasing composite restorations in the anterior region can only be created, if the clinician succeeds in achieving a close to perfect shade match between the restorative material and the remaining dentition. In general, state-of-the-art composite restoratives should be easy to handle and adapt to cavity walls and offer good surface finishing qualities. At the same time, however, it is essential that they allow the restoration to harmoniously blend into the natural oral environment.

Since esthetic integration is accomplished by placing special optical effects, composite materials with a high opacity (similar to dentin) and a relative translucency (similar to enamel) should be available. Composite restorative systems which additionally include an opalescent material that allows the bluish areas (frequently observed along the marginal ridges) and the yellowish-whitish portion of incisal edges to be reliably mimicked, offer just about everything the clinician needs to esthetically restore a case. The new IPS Empress® Direct system includes such an opalescent material, which due to its shade effects enables the optical phenomena mentioned above to be reproduced. What we call opalescence is an optical effect exhibited by some substances, which is caused by the different refraction of the various wavelengths of visible light due to the small structures in the substance. As a result, the substance exhibits an intensive bluish tinge in incident light, whereas it has milky yellowish appearance in transmitted light, just as it is the case in a natural opal stone. In restorations, this phenomenon can be described as follows: The light that hits the composite material and is reflected from it appears bluish. Against the light, however, the composite has a slightly milky appearance with a yellowish tinge. The incisal edge of natural dentition often has this appearance.

The clinical case which we will describe in this article involved the replacement of two defective proximal restorations (Fig 1). An initial analysis of the different shade layers, of which the natural teeth were composed showed that the optical incisal edge effects described above were particularly eye-catching in this case. Moreover, the bluish-whitish line extended far into the interproximal area. The challenge was to create a highly esthetic restoration. We strived to achieve this by means of a slight reduction of the diastema and the application of opalescent effects. In this article, we will describe how improved restorative results can be achieved if an opalescent material is additionally available (IPS Empress Direct Trans Opal).

Fig 1 Initial findings: defective restorations in teeth 11 and 21

Fig 2 Incisal view

The incisal view of the teeth shows the wavelike contour of the incisal edge (Fig 2). As secondary decay was diagnosed, the old fillings were completely removed (Figs 3 and 4). A perforated, one-sided diamond abrasive strip was used to bevel the preparation margin (Fig 5). In this way, minimally invasive roughening and bevelling of the enamel surface was ensured in the equigingival cervical region. Following etching with phosphoric acid and con-

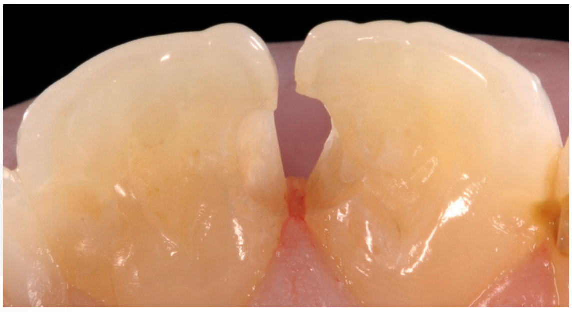

Fig 3 View after complete removal of the old fillings

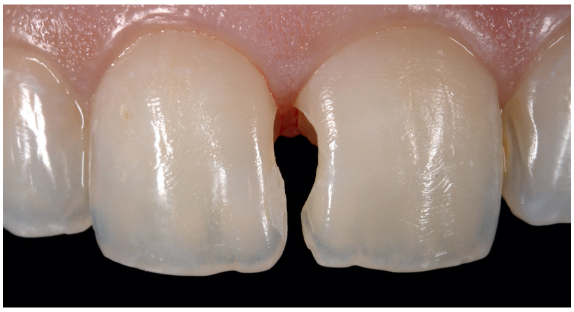

Fig 4 Defects seen from the vestibular aspect

Fig 5 Bevelling of the preparation margin using diamond abrasive strips

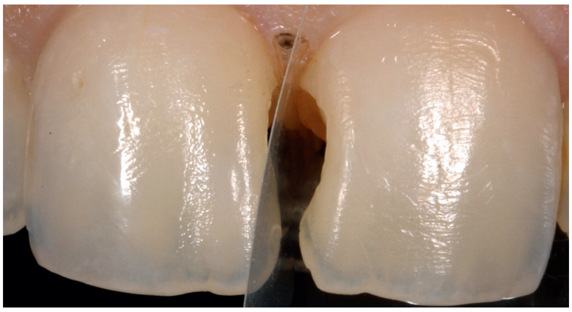

Fig 6 Placement of the matrix band

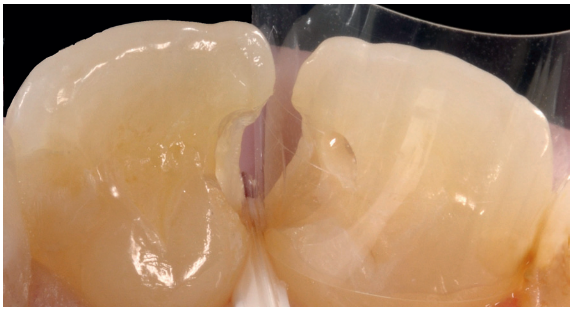

Fig 7 Palatal view

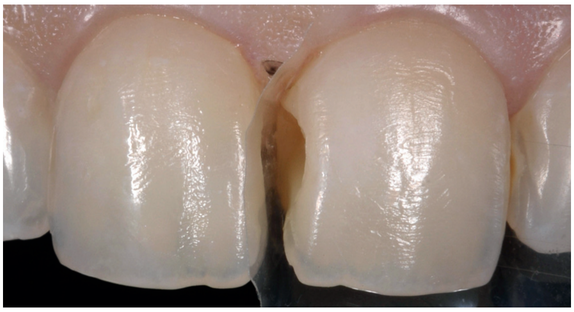

Fig 8 Application of the first composite increment

Fig 9 Further Dentin A3 increment

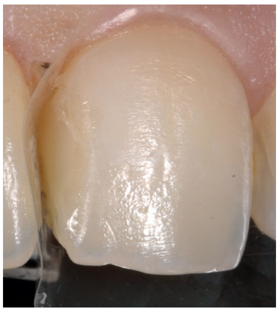

Fig 10 Completion of the dentin core using IPS Empress Direct Dentin A2

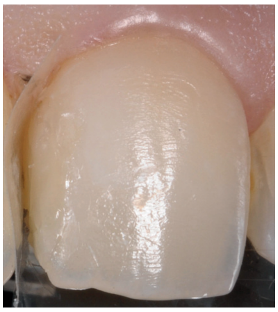

Fig 11 Coverage with enamel material, shade A2

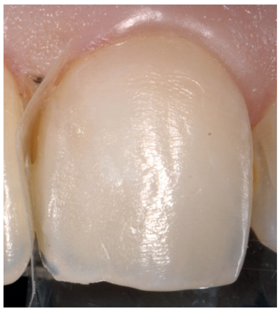

Fig 12 Contouring of the final tooth shape by means of Trans Opal

ditioning with ExciTE® bonding agent, a matrix band was placed (Fig 6). The band was slid into the sulcus along the proximal tooth surface and secured with a transparent wedge from the palatal side (Fig 7). The anaemic appearance of the surrounding gingiva showed that non-traumatic compression of the tissue was achieved. In the palatal view, the size-1 wedge is clearly visible. Due to the pressure it exerts, the interdental space is slightly enlarged. The matrix band was secured once in a optimum position. Then the first layer of composite material (IPS Empress Direct Dentin A3) was placed and adapted in such a way that it created a preliminary outline of the proximal contours (Fig 8).

Subsequently, a further layer of composite was added (Fig 9). This was followed by a layer of IPS Empress Direct Dentin shade A2 (Fig 10), which served to optimize the shade adjustment. As a next step, a layer of Enamel shade A2 (Fig 11) was placed and the build-up was completed with Trans Opal material. Figure 12 gives a good indication of how the composite materials were built up to create the final tooth shape, which also simplified morphological contouring during the finishing procedure. For finishing, an EVA tip handpiece was used. This handpiece performs oscillating movements. Due to the fine tip, completely non-traumatic finishing is ensured, particularly along the transition between the filling material and the sulcus. The fine reduction which is achieved by means of the suitable grit size (the green or blue ring are used for pre-polishing) enables finishing to be performed in a targeted manner. Therefore, overcontouring of the composite restoration is not necessary. The surface was finished exclusively with an EVA tip and subsequently polished with a pre-polisher and high-gloss polishers (Astropol®). Polishing brushes (Astrobrush®) were used to impart the surface with the final high-gloss sheen.

In tooth 11, a matrix band was used to shape the proximal surface (Fig 13). The band also served to protect tooth 21 from the etching gel which was applied immediately afterwards. The wedge was placed with tension to establish a perfect separation of the teeth. The intention was to substantially reduce the diastema. The primary composite increments were applied according to the protocol described above. The final layers were also placed based on the previously mentioned criteria. Also in this case, Trans Opal material was used to complete the build-up (Fig 14). After polishing the restoration to a high lustre, a slight colour discrepancy was recognizable due to the dryness of the superficial enamel portion. The interdental papilla was still slightly compressed due to the wedge (Fig 15). The final picture (Fig 16), which was taken one week after placement of the restoration, shows a completely healthy papilla and virtually invisible composite restorations demonstrating life-like opalescence. ❑

***Fig 13** Matrix band has been inserted in the interdental space 11 and 21, etching gel has already been applied.*

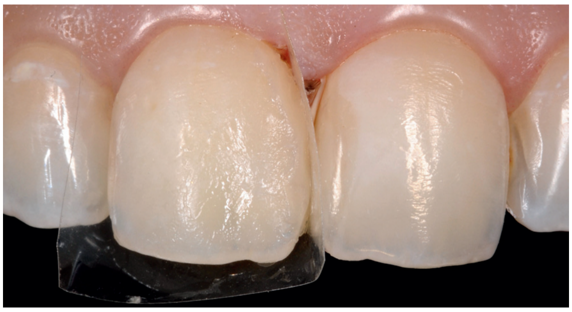

***Fig 14** To complete the composite build-up, a layer of Trans Opal is applied.*

***Fig 15** Situation immediately after completion of the treatment*

***Fig 16** Final picture taken one week after the treatment, showing complete closure of the interdental gap*

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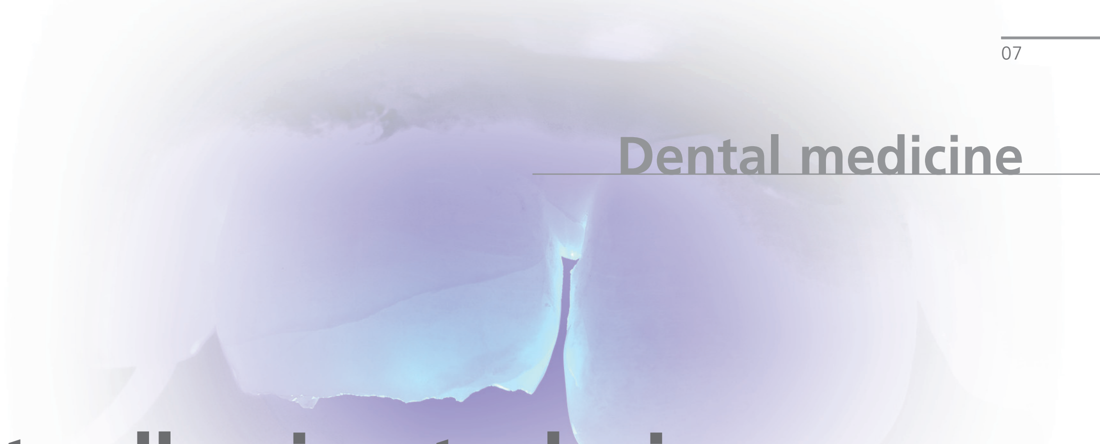

Efficient adhesive technique for applications “on the move”

A case study on the application of the new AdheSE One F

Dr med dent Alessandro Devigus, Bülach/Switzerland

Adhesives are instrumental in attaining a tight marginal seal when placing direct composite restorations or seating indirect restorations with the adhesive technique. Various versions of different systems are available for this purpose.
Self-conditioning materials represent the latest development in dental adhesive technology. In addition to achieving high bond strengths, streamlining the application procedure was one of the main goals in developing this type of adhesives. Self-conditioning adhesives have also been described as smear layer dissolving systems. In contrast to products that require a separate etching step, self-etch adhesives incorporate self-etching primers in their formulation and therefore eliminate the need for separate enamel and dentin etching with phosphoric acid. The latest protagonists of these one-bottle systems now also contain fluoride. The fluoride which is released in the first few days after placing a restoration is useful to achieve a tight seal of the dentin tubules due to the formation of calcium fluoride and therefore helps avoid postoperative sensitivities. Multiple-bottle systems such as Syntac will probably continue to be considered the gold standard in dental adhesives. Nonetheless, it is worthwhile keeping abreast of the latest products in adhesive technology.
The present case study describes the practical application of AdheSE® One F.

Case study

In addition to my work in the dental practice, I am also the team dentist of several ice hockey clubs. The combination of AdheSE One F, a light-curing composite resin (Tetric Evo Ceram®) and an LED curing light (bluephase®) forms a useful kit to provide effective, straightforward dental treatment on a small scale in the surroundings of a sports stadium. Emergency treatments, such as splinting or small tooth build-ups, can thus be performed without having to rely on the infrastructure of a dental practice.
Figure 1 shows the oral situation after the patient had been struck by an ice hockey stick: fractured tooth 21. The sharp edges were removed with the help of an interdental strip. A rubber dam (e.g. Optradam®) was applied to ensure a dry working field (Fig 2). Next, the enamel and dentin was conditioned in a single step using AdheSE One F (Fig 3). The innovative VivaPen and the flocked cannula

Fig 1 Initial situation: fractured incisor

Fig 2 The working field is isolated with a rubber dam.

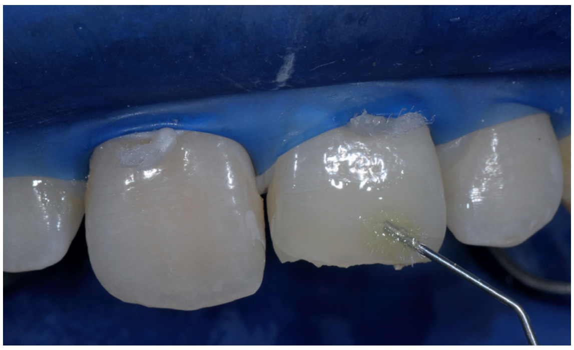

Fig 3 AdheSE One F is applied and brushed into the tooth structure.

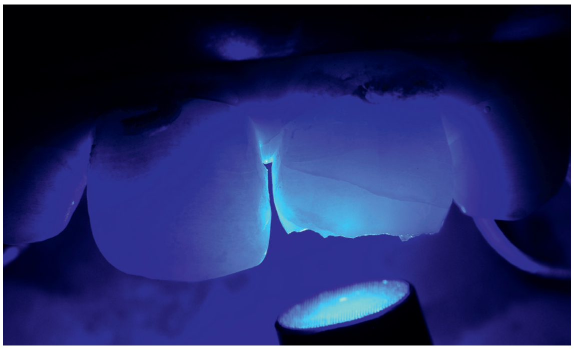

Fig 4 The bonding agent is light cured using the Low Power program.

Fig 5 The tooth is built up in layers using composite material.

Fig 6 Restoration on the day of the treatment

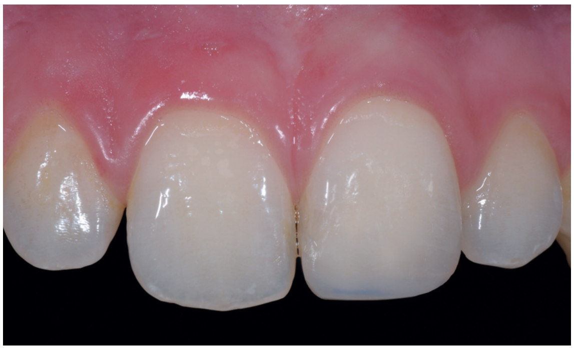

Fig 7 Final picture after the recall and high-gloss polishing

allow the adhesive material to be applied in a clean, economical fashion. Subsequently, the material was light cured with a bluephase LED unit (Fig 4). Now, Tetric EvoCeram was applied in layers using a spatula (Fig 5). Each layer requires light curing for at least 10 sec with the High Power mode of the bluephase light (1200 mW/cm^2).
The final layer was smoothed out with a brush. Figure 6 shows the completed, unpolished restoration after final light curing. The restoration was polished to its final gloss in the course of the subsequent recall in the dental practice. Figure 7 shows the completed restoration after having been polished to a high gloss with AstroPol® and Astrobrush®.

Conclusion

The new AdheSE One F enables dental professionals to apply the adhesive technique effectively in demanding circumstances outside the surroundings of the dental practice. ❑

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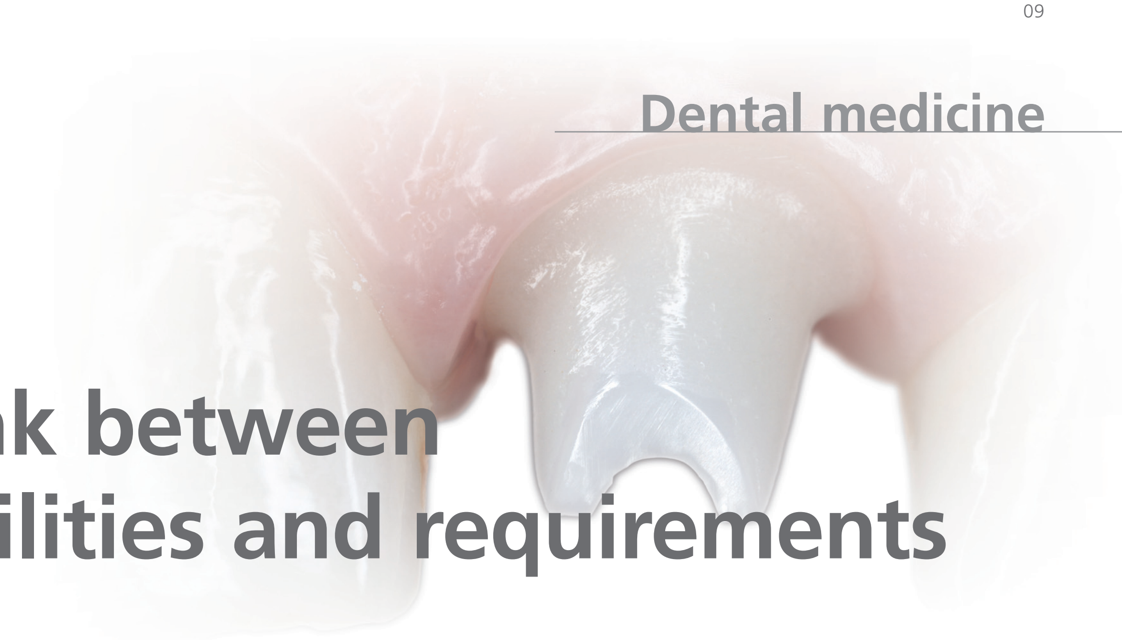

The link between possibilities and requirements

Straumann Anatomic IPS e.max Abutments in implant-retained restorations in the esthetic zone

Dr Andreas Kurbad, Viersen-Dülken/Germany

Today, dental professionals have the resources at hand to offer their patients implant-retained single-tooth restorations that are difficult to distinguish from the natural dentition. Improvements in implant design, optimized operating techniques and the development of ceramic materials for the fabrication of superstructures have made this possible.

Abutments play a key role in creating esthetic implant-retained restorations. The abutment is the link between the implant and the crown. Moreover, it is also responsible for linking the surgical possibilities, which are not always optimal, with the requirements of highly esthetic restorations. For example, this involves balancing out the axes of the implant and the crown, which are rarely identical. The critical factors for fabricating successful restorations in the esthetic zone are summarized in Table 1.

In order to maintain the tissue surrounding the restoration free from inflammation, the materials used must show excellent biocompatibility. Zirconium oxide fully meets this requirement. Furthermore, this material exhibits the strength needed to resist high mechanical loading. The shape of the abutment also plays an important role, as the creation of a tooth-like emergence profile is essential. Therefore, a space between the implant shoulder and the gingival margin of at least 2 mm is needed. This depth of insertion is best achieved with a bone level implant (e.g. Straumann® Bone Level Implant). A special secondary component has been developed for this type of implant in a partnership agreement between Straumann and Ivoclar Vivadent. The anatomically pre-shaped abutment is used in combination with the Straumann CrossFit Connector, which significantly contributes to the long-term preservation of crestal bone levels. Direct cementation of the abutment on the implant is contraindicated for the main reason that cement residue cannot be removed or controlled in areas near the implant shoulder. The shoulder of the abutment has a chamfer to accommodate the crown. As a result, time-

Critical factors for the success of implants in the esthetic zone
High biocompatibility of the materials used
Tooth-like emergence profile
Screwed connections in hard-to-reach joint areas between the implant and abutment
Tooth-like colour
Light transmission in subgingival areas

Table 1 Critical factors for the success of implants in the esthetic zone

consuming adjustments are almost entirely avoided. The fact that the abutment is available in two gingiva heights and two angles (0° and 15°) also facilitates the procedure. The shape of the abutment can be customized by careful grinding. Furthermore, either the press-on or veneering technique may be used to fabricate the ceramic restoration for the abutment. If a glass-ceramic is used (IPS e.max® Ceram), this area can even be conditioned with silane and etched to improve the adhesive bonding of the crown. The optical properties of ceramics are of major importance in the creation of esthetic restorations. The soft tissue covering the abutment, and the thinly tapering gingival part in particular, looks healthier and more natural, if white, or even better tooth-coloured, material is used as opposed to metal. Consequently, the Straumann Anatomic IPS e.max Abutment is available in shades MO 0 and MO 1. Moreover, it is important for the material to transmit light to the root as is the case in natural teeth. This characteristic enhances the appearance of the gums. Zirconium oxide conducts light to a certain extent, which also sets it apart from metal. In contrast to root dentin, however, zirconium oxide does not exhibit fluorescence. Nevertheless, this effect can be imparted in the course of optimizing the emergence profile by apply-

***Fig 1** Preoperative situation of a 30-year-old female patient with a root-treated tooth 21*

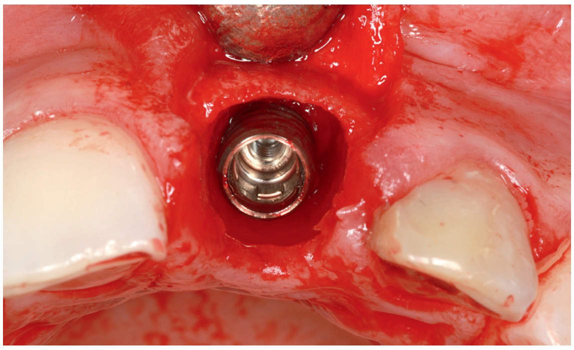

***Fig 2** Immediate implantation of a Straumann Bone Level Implant*

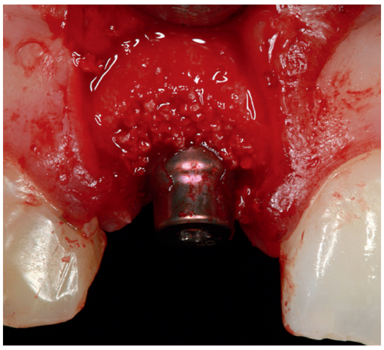

***Fig 3** Bone graft with Straumann BoneCeramic*

***Fig 4** An optimum emergence profile is shown after only eight weeks following the insertion of the implant.*

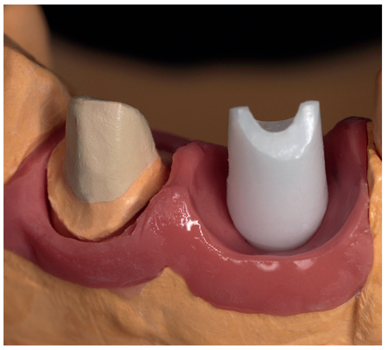

***Fig 5** Selection and adjustment of the Straumann Anatomic IPS e.max Abutment*

***Fig 6** The emergence profile is efficiently customized with IPS e.max Ceram Margin material. In the process, the decisive sub-gingival fluorescence is imparted.*

***Fig 7** The IPS AcrylCAD blank shapes are transformed into ceramic with the press technique.*

***Fig 8** Incisal areas are cut back and then built up with enamel materials.*

ing fluorescent Margin materials from the IPS e.max Ceram assortment. A restoration comprising an abutment which has been customized in this way and an all-ceramic IPS e.max® Press or CAD crown can hardly be distinguished from the natural dentition.

The step-by-step procedure

The complete procedure in which a Straumann Anatomic IPS e.max Abutment is used is presented on the basis of a clinical case. A 30-year-old female patient experienced recurring problems with tooth 21, despite the fact that a root resection had been performed five years previously (Fig 1). The tooth could not be saved and was therefore extracted. A Straumann Bone Level implant was placed immediately (Fig 2). The gap between the alveolar bone and the implant was filled with Straumann® BoneCeramic (Fig 3).

Active tissue management started at this early stage with suitable suturing techniques and a gum moulder. After a healing period of six weeks, the first impressions were taken for the fabrication of a provisional abutment and a provisional crown, which would be used to mould the emergence profile. A provisional abutment for the Regular CrossFit Connection (RC) was selected from the Straumann assortment.

After eight weeks, the emergence profile satisfied the requirements of a highly esthetic restoration (Fig 4). At this stage, the second impression was taken for the final

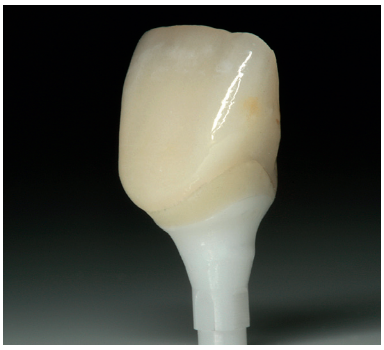

Fig 9 Exceptional fit of the all-ceramic crown on the customized shoulder

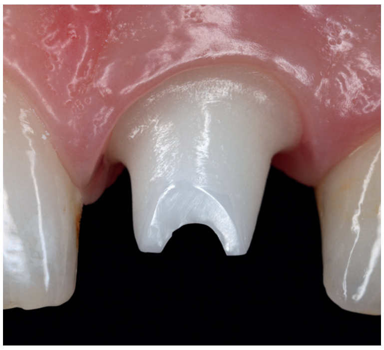

Fig 10 The tightened Straumann Anatomic IPS e.max Abutment

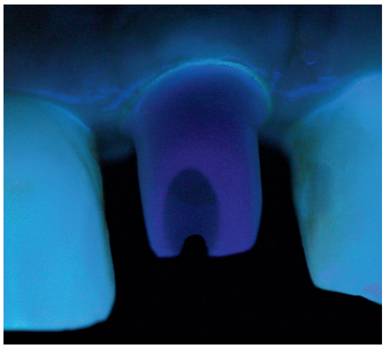

Fig 11 Clear presentation of the fluorescent effect under UV light

Fig 12 The new luting composite Multilink Implant together with the improved Monobond Plus as the bonding agent between oxide and glass-ceramics

Fig 13 Close-up of the situation after cementation. No metallic shadows are visible in the gingival tissue.

restoration. In the process, it was important to replicate the shape of the soft tissue exactly. However, as the relatively soft gingival tissue could easily collapse under the impression, the impression post had to be individualized to provide adequate support. After the fabrication of the master cast, a removable gingival matrix was produced. The appropriate secondary component was selected and customized as needed (Fig 5). The gap between the abutment and the gingival margin was filled with IPS e.max Ceram Margin material (Fig 6). ZirLiner was applied to establish a sound bond between the zirconium oxide and the veneering ceramic. After firing, small adjustments of shape were made. The base part was glazed to obtain a shiny, tissue-compatible surface. Next, the crown was fabricated. The blank shape was milled from IPS AcrylCAD and the crown was subsequently pressed with IPS e.max Press (Fig 7). The incisal area was cut back and then built up with translucent IPS e.max Ceram Enamel and Transpa materials (Fig 8). The completed crown showed excellent fit and rested on the fired Margin material (Fig 9). The fluorescent effect achieved in this area would be of particular importance for the final overall esthetic result (Fig 11).
The abutment was carefully inserted. A ratchet together with a torque control device was used to tighten the abutment to 35 Ncm (Fig 10). The significance of a fluorescent shoulder was clearly shown in a clinical picture of the abutment (Fig 11). Subsequently, the crown was placed with an adhesive luting composite. The cervical areas made of glass-ceramics as well as the inner surfaces of the crown were etched. Monobond Plus Universal Primer was applied to all the bonding surfaces. To prevent the penetration of composite excess, a retraction cord was placed. Adhesive cementation was carried out with Multilink® Implant (Fig 12). Excess cement was meticulously removed and the function of the restoration was carefully inspected before the treatment was concluded (Fig 13).

The author would like to thank Dentallabor Reichel in Hermeskeil, Germany, for the dental work. ❑

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Enhanced light transmission

Monolithic, all-ceramic implant-retained CAD/CAM crowns made with esthetic lithium disilicate glass-ceramic

Dr Andreas Bindl, Zurich/Switzerland

Because of esthetic reasons, the demand for implant-retained restorations composed of ceramic abutments and all-ceramic crowns is increasing. Zirconium oxide ceramics are used to manufacture the implant abutments, since they fulfil today's strength and tissue compatibility requirements. Moreover, the combination of a ceramic abutment and an all-ceramic crown enhances the transmission of light through the peri-implant tissue.

All-ceramic abutments are industrially manufactured, or they are milled in centralized CAD/CAM centres. It is not yet possible to machine customized abutments chairside with the CEREC system (Sirona). Nevertheless, chairside methods can be used to a certain extent in that the dentist can customize an industrially fabricated zirconium abutment directly in the mouth of the patient. After the abutment has been customized, a full-contour crown is constructed with the help of CEREC 3D software techniques. The crown is then crafted from a highly esthetic, easy-to-mill, but in contrast to zirconium oxide weaker, ceramic (e.g. IPS Empress® CAD). Some time ago, a high-strength (360 MPa) machinable lithium disilicate (LS_2) glass-ceramic (IPS e.max® CAD) was added to the range. This ceramic is machined in the metasilicate state. In the subsequent crystallization process, which takes about 25 minutes, the ceramic is transformed into its final state. In this process, the material obtains its excellent mechanical and esthetic properties. The restoration can be stained and glazed at the same time. As a result, polishing becomes superfluous. As space is often limited when implant-supported crowns are used and therefore a minimum ceramic thickness of 1.5 mm cannot always be ensured in occlusal areas, lithium disilicate glass-ceramics offer significant strength reserves in these situations.

This article describes the clinical and technical procedure involved in the fabrication of IPS e.max CAD (LS_2 ceramic) crowns on customized abutments in one appointment.

Clinical case

A 28-year-old female patient consulted us about closing the gap resulting from the loss of tooth 15. As the adjacent teeth were intact, a single-tooth implant was indicated. The anatomical conditions allowed us to place a 10 mm wide NanoTite™ implant (Biomet 3i) with a diameter of 5 mm. The implant shoulder was situated at bone level. As augmentative measures were unnecessary, transgingival healing was possible (Fig 1). After a healing phase of eight weeks, a restoration was placed on the implant. The osseointegration of the implant was clinically and radiologically verified. The healing abutment was removed and an industrially manufactured zirconium oxide abutment (ZiReal®, Biomet 3i) with a platform diameter of 4 mm was selected (so called platform switching). The abutment was provisionally attached to the implant with a gold screw (Gold-Tite®, Biomet 3i). A close examination revealed that the height and preparation margin of the abutment needed to be adjusted to the clinical situation. The abutment was adjusted directly in the mouth of the patient using a diamond bur and a high-speed contra-angle handpiece. After the adjustments had been made, the preparation margin was located exactly at gum level. Due to the confined space, a chamfer was prepared (Fig 2). The abutment was then screwed in place and the gold screw tightened to 20 Ncm. The screw canal access opening was sealed with a provisional composite material (Fermit®). The customized abutment was now ready to receive a crown at chairside.

Fig 1 Situation after the placement of an implant at the site of the lost tooth 15 and osseointegration of the implant

Fig 2 Intraoral customization of a zirconium oxide abutment prior to optical impression-taking

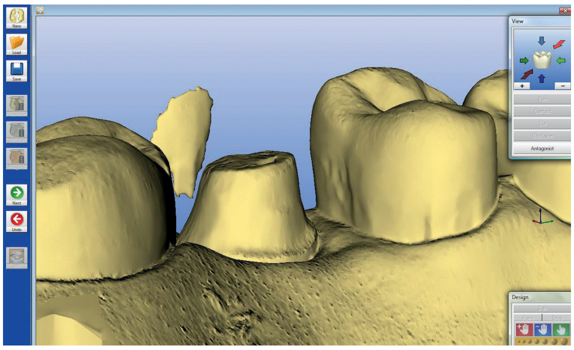

Fig 3 3D model produced by the CEREC software V3.60 (palatal view of the chamfer preparation)

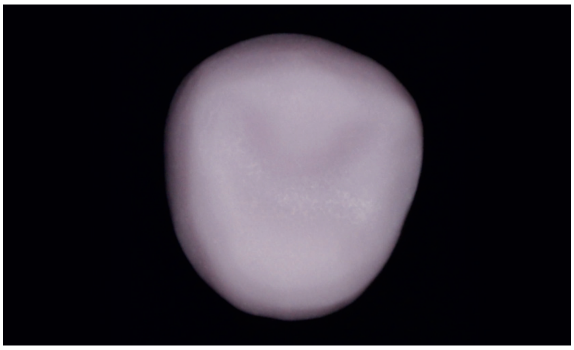

Fig 4 Lithium disilicate (LS_2) implant-retained crown in the pre-crystallized state after machining

Fig 5 Buccal view of the implant-retained crown during try-in

Fig 6 Occlusal view of the implant-retained crown during try-in

The abutment and adjacent teeth were coated with IPS Contrast Spray to create a non-reflective surface. The optical impression of the abutment was taken with the new CEREC Bluecam oral camera of the acquisition unit. Furthermore, images were taken of the mesial and distal areas and from various angles. To ensure the correct reproduction of the occlusion, a centric bite record was produced and photographed intraorally with the CEREC Bluecam. The implant-retained crown was designed with the help of the latest software V3.60 of the acquisition unit (Fig 3). In the process, the basic shade A1 was determined. Subsequently, the restoration was milled from an IPS e.max CAD LT blank in the blue state (Fig 4). Minimal shrinkage of the ceramic (0.2 %) during the crystallization process was taken into account by the software and compensated accordingly.

After the milling procedure, the support stub was removed and the crown placed on the abutment. Next, the proximal and occlusal contacts and the fit of the crown were checked in the patient's mouth (Figs 5 and 6). The shade named "sunset" was selected from the corresponding range of stains (IPS e.max CAD Crystall./Stains) for the tooth neck and the fissures and applied sparingly. Immediately following this step, the

Fig 7 Implant crown after staining with IPS e.max CAD Crystall./Stains and after the crystallization process

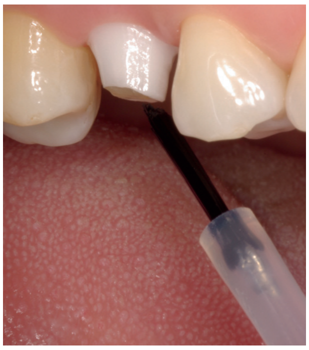

Fig 8 Conditioning of the dried zirconium oxide abutment surface with Monobond Plus

Fig 9 Cementation of the implant-retained crown with the dual-curing Multilink Implant luting composite

Fig 10 Occlusal view of the implant-retained crown placed with the adhesive bonding technique

Fig 11 Buccal view of the implant-retained crown placed with the adhesive bonding technique

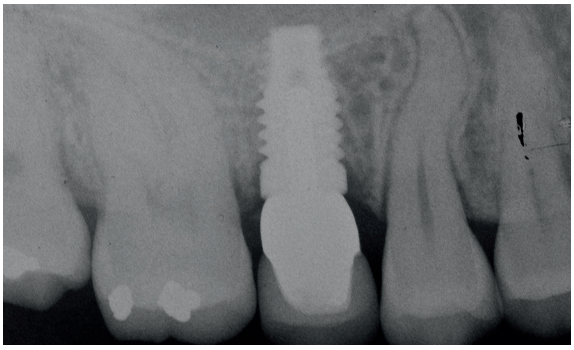

Fig 12 Final X-ray of the implant, zirconium oxide abutment and lithium disilicate glass-ceramic crown

outer surface of the crown was coated with IPS e.max CAD Crystall./Glaze Spray. The spray was repeatedly applied until the surface exhibited an opaque white layer. The crown was subjected to combined crystallization and glaze firing in the Programat® CS furnace (Fig 7).

The implant-retained crown was cemented with the new Multilink® Implant luting composite. In preparation for cementation, the inner surfaces of the crown were etched with 4.9 % hydrofluoric acid (IPS Ceramic Etching Gel) for 20 seconds and subsequently conditioned with Monobond Plus for 60 seconds. The zirconium oxide surface of the dried abutment was also conditioned with Monobond Plus (Fig 8). The crown lumen was filled with shade MO 1 of the dual-curing Multilink Implant material and the crown was placed on the abutment (Fig 9). Excess cement was efficiently removed with the "quarter technique". Four short polymerization cycles (approx. two seconds) per proximal surface followed (from the buccal and palatal aspects in each case) using the bluephase® LED curing light in the Low Power mode. In the process, the luting composite acquired a gel-like consistency, which allowed it to be removed with ease using a scaler and a probe. In proximal areas dental floss was used. Finally, the restoration was light-cured again from the buccal, occlusal and palatal aspects (for one minute each in the High Power mode). Subsequently, the cement margin was polished with flexible discs. The final restoration exhibited a harmonious overall appearance (Figs 10 and 11). The final radiograph shows the implant, the zirconium oxide abutment and the lithium disilicate ceramic crown placed according to the adhesive bonding technique (Fig 12). ❑

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When esthetics matter

New standards in dental esthetics

Dr Stefen Koubi, Marseille/France, and CDT Hilal Kuday, Istanbul/Turkey

One of the major issues leading to unsatisfactory results when fabricating several ceramic restorations in the anterior region is the integration in terms of shade. The situation found in patients is often a combination of discoloured prepared teeth, metal constructions and teeth showing no discolouration. Achieving a harmonious overall appearance in such situations is a challenge.

Nowadays, the use of glass-ceramic materials, such as the IPS e.max® Press lithium disilicate (LS_2) material, is the textbook approach in terms of the esthetic integration, for two good reasons:

- These materials offer the possibility of creating unique translucent restorations which mimic the dental enamel.
- The wide array of cementation possibilities facilitates the creation of lifelike results.

In the past, severe discolouration was often a reason why glass-ceramics could not be used to fabricate restorations. The constant improvement of the materials, however, has led to the development of a comprehensive system: IPS e.max. This system offers the advantages of press ceramics – such as accuracy of fit and esthetics – while eliminating the drawbacks that existed previously – i .e. restricted use on dark preparations. The fact that we have glass-ceramic materials in various levels of opacity and translucency at our disposal thus opens up a whole range of new possibilities. We can now cover the entire spectrum of single-tooth and small bridge restorations with glass-ceramics – regardless of the underlying tooth structure.
Discoloured teeth or metal structures are also no longer a reason for avoiding lithium disilicate glass-ceramics.

***Fig 1** Initial situation*

***Fig 2** Clinical view of the initial restorations*

Case study

The use of frameworks and restorations in different levels of translucency is presented here on the basis of a multi-disciplinary case study. The objective in this case was to recreate the esthetics of the patient's anterior teeth on a natural tooth and a metal core build-up.
The patient expressed the wish to improve the appearance of his anterior teeth. The initial examination revealed that the periodontal tissue was inflamed and in generally poor condition (Figs 1 and 2).

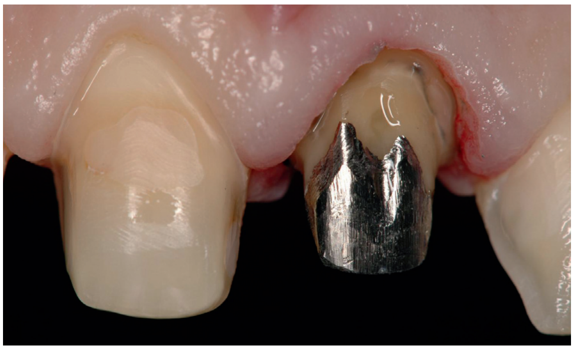

Fig 3 Different preparations depending on the type of underlying structure

Fig 4 Preparations

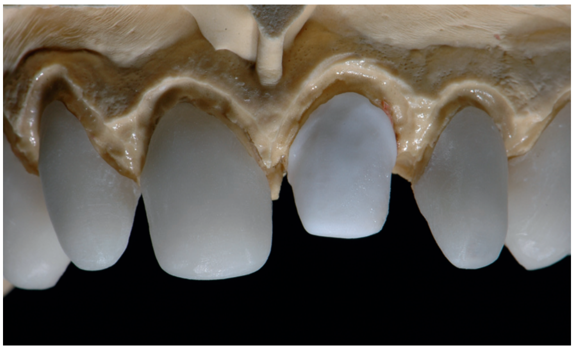

Fig 5 Variable opacity according to the selected ingots

Fig 6 Translucent and opaque frameworks after pressing

Fig 7 IPS e.max Press HO (high opacity)

Fig 8 IPS e.max Press HT (high translucency)

After the initial treatment, the condition of the periodontal tissue had improved enough to allow the restorative procedure to be conducted with adhesive cementation.
An analysis of the situation presented by the patient from an esthetic point of view revealed that older ceramic restorations and numerous composite root canal posts were responsible for creating an inharmonious appearance.
An esthetic concept which was based on the existing tooth shapes was drawn up to help preserve the individual characteristics of the patient. Subsequently, the necessary preparations were carried out (Figs 3 and 4). IPS e.max Press ceramic restorations (veneers and crowns) were fabricated for the entire upper jaw (Figs 5 to 8).

The IPS e.max Press frameworks were layered with one layering ceramic (IPS e.max® Ceram) regardless of their translucency level. The result was thus a balanced look.
The restoration design was dictated by the underlying tooth structure. For crowns which were placed on metal substrates, press ingots with a higher opacity (HO = high opacity) were used. In addition, the thickness of the restorations was increased in order to mask the metal colour and achieve lifelike layering.
The veneers were considerably smaller and LT (low translucency) ingots with a translucency higher than that of MO or HO ingots were used. A thickness of approx. 0.5 mm was sufficient in order to allow the dentin shade to shine through the translucent framework and thus create the desired chameleon effect.

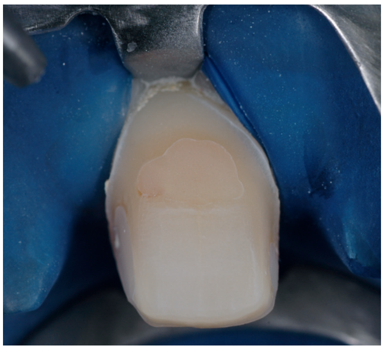

Fig 9 Tooth isolation with a rubber dam

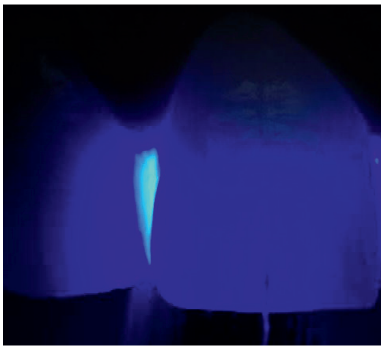

Fig 10 Even light scattering in the translucent frameworks

Fig 11 IPS e.max HO framework with metal substructure

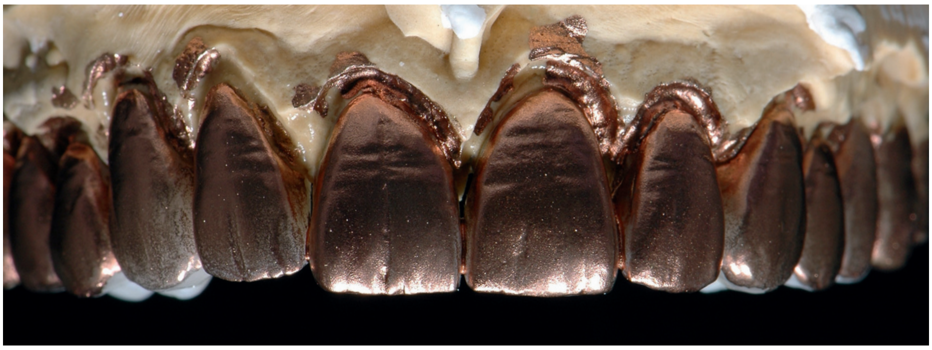

Fig 12 Visualization of the surface structure with gold powder

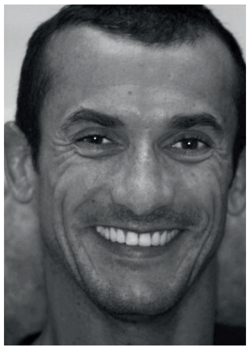

Fig 13 A happy patient

Fig 14 View from the side: excellent shade match

Fig 15 Final result

Clear communication between the dental practice and the laboratory is indispensable to ensure that both the clinician and the laboratory have the same information about the preparations in the situation at hand.
The view of the pressed opaque and translucent frameworks illustrates the versatility of the IPS e.max system (Figs 7 and 8).
The optical properties are harmonized by layering IPS e.max Ceram onto the pressed frameworks (Figs 10 and 11).
Particular attention was paid to the surface treatment and the design of a macro- and micro-pattern in order to achieve natural-looking light effects (Fig 12). After try-in and adjustment, the restorations were cemented with Variolink (transparent) while using a rubber dam, in order to ensure that every restoration was isolated (Fig 9). By using a versatile ceramic and cementation system and by imitating the light effects, lifelike restorations were fabricated in spite of the suboptimum initial situation (Figs 13 to 15). ❑

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Harmonizing esthetics and expectations

Anterior esthetic restorations with lithium disilicate (LS_2)

DT Carlos de Gracia, Las Palmas/Spain

When anterior teeth require repair, all of a sudden countless expectations and opinions come into play, aired by all parties involved in the treatment. While the diagnosis, functional analysis and material selection may rest on the dentist or dental technician, patients have an increasing say in other aspects of the treatment, such as approval of the cost estimate for the appropriate treatment option and the final esthetic result. We, dental professionals, find it increasingly more difficult to satisfy the high esthetic expectations of our patients. We have to put ourselves into their position to understand their high demands and accomplish a lifelike esthetic reconstruction.

Case study

When it comes to esthetics, patients generally fall into one of two categories:

a) The first of these aspire to an esthetic appearance that is influenced by the trends and images in current fashion.

b) The second prefers a dental reconstruction that matches their adjacent teeth, age, etc. Generally, these patients require a lifelike reconstruction that naturally blends into the oral environment.

To accomplish a lifelike reconstruction, the communication between the patient, dentist and dental technician is essential to ensure that each case is appropriately individualized and the unique needs of the specific patient are accurately analysed.

We used the photograph which we received from *Dr Manuel Pérez Fierro* of the current oral status of the patient to assess the esthetic, functional and morphological options to create the reconstruction (Fig 1).

Upon completion of the analytical stage, a diagnostic wax-up was produced, using the study model as a basis. This wax pattern included certain aspects, such as proportions regarding the morphology, symmetry, composition and tooth length. For their part, these proportions were affected by the parameters dictated by the jaw movements (Fig 2). This procedure allowed us to involve the patient in the reconstruction from the beginning and, consequently, he was capable of forming a picture of the final result already at this stage.

After the teeth had been prepared and the temporaries placed, the case was sent to the dental laboratory (Fig 3).

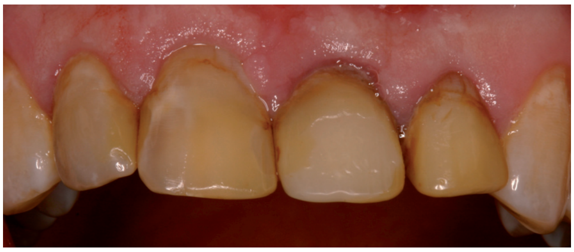

***Fig 1** Initial photograph of patient: note the general condition of the tooth structure and pigmentation.*

***Fig 2** Diagnostic wax-up*

***Fig 3** Temporization*

Fig 4 IPS e.max Press frameworks with the desired esthetic properties

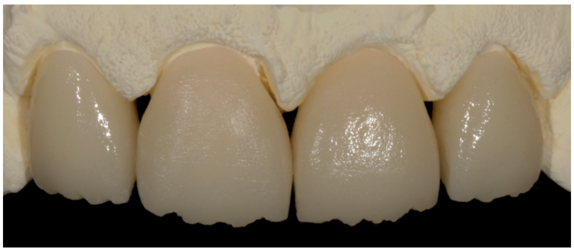

Fig 5 Framework after application of IPS e.max Shade

Fig 6 Individualized frameworks with IPS e.max Essence

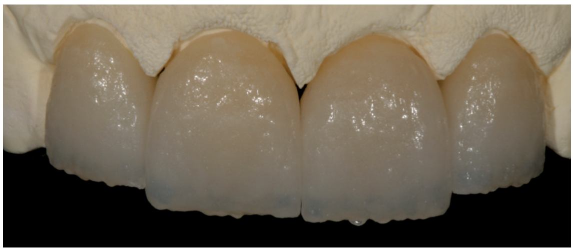

Fig 7 Result after firing the IPS e.max Ceram materials

Clinical case: result with IPS e.max Press LT A1

This patient fell into the above-mentioned second category of people, who favour a lifelike dental reconstruction, which naturally blends into the oral surroundings and matches the patient's general esthetic characteristics.
We decided to use the IPS e.max® Press lithium disilicate (LS_2) glass-ceramic for the anterior reconstruction. This material offers essential advantages in creating the substructure of the restoration. In spite of its high strength, it offers an impressive level of translucency, simulating the translucent qualities of the natural tooth structure. IPS e.max Press offers the opportunity to select between various degrees of translucency and opacity in relation to the dental preparation and the resulting shade of the remaining tooth structure. Consequently, we can take advantage of extensive possibilities to achieve the desired esthetic effect easily (Fig 4).

With regard to its physical properties and flexural strength in particular, this lithium disilicate ceramic proved to provide reliable results many times in my laboratory in the course of the past few years. Additional decisive fundamental factors that, for me, speak in favour of this material are as follows:

- straightforward, familiar working technique (press technique)
- reliable bond between framework and the IPS e.max Ceram veneering ceramic
- possibility of adhesive cementation in combination with etching and silanizing and chemical bonding with the remaining tooth structure.

After I had clarified the esthetic expectations of the patient and specified the treatment with him, I decided to use the IPS e.max Press LT (low translucency) ingots for the reconstruction. If the initial situation (shade of prepared teeth) and the remaining teeth are considered, these ingots offer an appropriate degree of translucency for the present case.

Before investing and pressing, the diagnostic wax-up was reduced by a mere 0.6 mm on the vestibular side (a more substantial reduction was not necessary because of the favourable colour saturation of the LT ingots). To enhance the translucency in the incisal area, the incisal edge was reduced to a slightly larger extent to be able to subsequently reconstruct the incisal third with the IPS e.max® Ceram layering ceramic in an individualized manner. In principle, the diagnostic wax-up should be modified to such an extent that it corresponds to the proper dentin structure and, consequently, to approx. 80 % of the overall volume of the restoration.

Individualized layering of the incisal contour

The dentin portions of the IPS e.max Press LT material were characterized before applying the incisal materials. This technique allows essential areas of the reconstruction to be saturated from inside with Shade and Essence materials and to achieve an individualized shade with the first firing (foundation firing; Figs 5 and 6).
As the basic shade was already present in the pressed and characterized framework, the application of additional dentin material was not necessary. On account of my own experience with the IPS e.max system, however, I recommend applying a fine layer of dentin material on the transition area between the incisal and cervical portions. The appearance, texture and light refraction of the press material and the IPS e.max Ceram veneering material slightly differ from each other (higher translucency of veneering ceramic).
In the course of the same application, appropriate effect materials (IPS e.max Ceram Impulse materials) can be applied in layers to achieve additional individualized effects while taking the shade characteristics of the teeth into account. A balanced combination of the different materials in terms of opalescence, translucence and pigmentation results in a transitional shade effect, which simulates the characteristics of the natural tooth (Fig 7).

Fig 8 "Esthetic" try-in to check the shade and shape before glazing

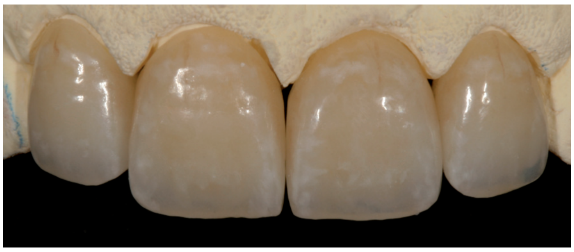

Fig 9 Completed restoration on the model

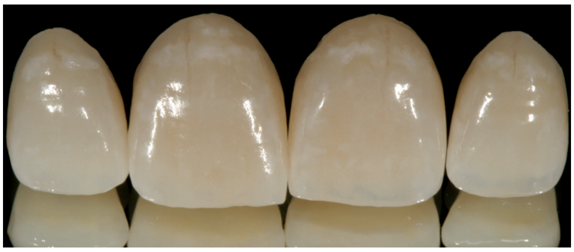

Fig 10 Individualized characteristics such as shade and texture

Fig 11 Satisfactory integration of the restoration into the gingival tissues shortly after placement

Fig 12 Lateral view of IPS e.max Press reconstruction

Fig 13 Final result

Minor adjustments may be performed at any time, should it be possible to conduct an "esthetic" try-in to check the shade and morphology before finishing the reconstruction (Fig 8).
Following the try-in, an additional layering and firing step may be conducted to adjust the morphology and shade of the restoration. Final glazing and mechanical polishing of specific areas of the facial surface resulted in a surface texture that closely resembles that of the remaining teeth (Figs 9 and 10).
As in all cases for which I used lithium disilicate (LS_2), the gingival tissues quickly gained their optimal healthy condition a very few days after seating the restoration (Fig 11).
A lifelike reconstruction offering a high level of esthetic acceptability was achieved by using a straightforward and predictable technique, selecting appropriate IPS e.max Press ingots and combining them with the IPS e.max Ceram layering materials (Figs 12 and 13).

Conclusion

In today's dentistry, highly esthetic reconstructions can be easily achieved by being aware of the patient's expectations, communicating well with the dentist and selecting appropriate materials and working techniques. In the process, a high level of patient satisfaction is attained. ❑

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Zirconium oxide blocks in the course of time

New options in sintering technology

MDT Volker Brosch, Essen/Germany

Zirconium oxide as a framework material has recently attracted particular attention. Initial doubts with regard to the physical and chemical properties of this material and the often contradictory scientific information are still the cause for many concerns among users.

As a result of the development of the CAD/CAM technology for dental applications, the production of pre-pressed or pre-sintered zirconium oxide ingots and the development of suitable sintering furnaces for zirconium oxide, many laboratories are fabricating their restorations in-house nevertheless. Aspects such as the shrinkage during sintering and the corresponding compensation by CAD/CAM software, the potential distortion occurring in objects with a large span and the sinter quality from a technical point of view are thus becoming more important.
Sintering furnace technology has taken a quantum leap with the development of the Programat® S1. This furnace has been the topic of constant discussions since it was first presented at IDS 2009 in Cologne. Underneath its very discreet design, this piece of technical equipment is exceptional.

At first glance, Programat S1 could just as well be mistaken for a ceramic or press furnace. Only the program selection identifies it as a sintering furnace for zirconium oxide.
The furnace's highlights are:

- low weight of 27 kg
- power consumption of 8 A at 240 V
- sintering time of 90 minutes for pre-dried IPS e.max® ZirCAD single-tooth crowns
- sintering time of just 180 minutes if different objects are placed in it (crowns and bridges)
- conventional program for sintering other/future ZrO_2 materials
- free program slots for saving individually created programs
- placement of the objects to be sintered on a flat tray without requiring the use of beads.

Does such a delicate-looking furnace meet the requirements in terms of sinter quality and accuracy of fit?
I would like to answer this question on the basis of a clinical case. In my capacity as dental technician, I can only assess parameters such as accuracy, distortion, etc; for the chemical and physical properties, I have to rely on the information provided by the manufacturer.
In this case, a zirconium oxide bridge for the teeth 15 to 26 and 36 to 46 had to be fabricated. The

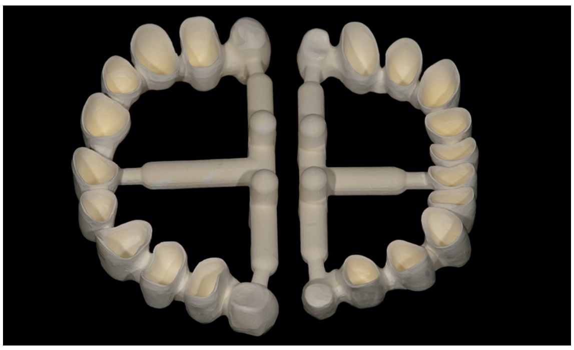

***Fig 1** After having been immersed in the IPS e.max ZirCAD Colouring Liquid for three minutes, the frameworks show a consistent shade.*

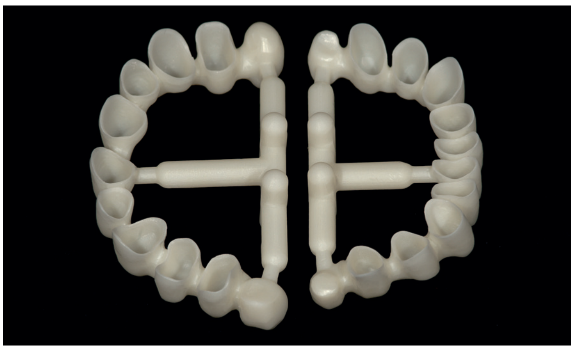

***Fig 2** The consistent shading is visible immediately after the sintering process.*

Fig 3 The accuracy of fit is excellent, even of large-span bridges.

Fig 4 Unlike metal frameworks, these restorations do not become distorted in subsequent firing cycles.

Fig 5 The wax-up for pressing IPS e.max ZirPress on the framework. It allows good control of the functional relations.

Fig 6 The object is removed from the press button while the bridge is still embedded in the investment material.

Fig 7 Silicone keys from the oral aspect allow the framework to be reduced accordingly for the subsequent application of the veneering material.

Fig 8 Individualization with Shades and Stains

Fig 9 Due to the silicone keys, the natural teeth can be faithfully recreated with IPS e.max Ceram.

patient had lost some posterior teeth after a severe illness and the anchorage of the teeth in the bone was fragile. I was asked by the dentist to fabricate the frameworks in one piece for the entire jaw, allowing the restoration to be maintained in case of tooth loss. As a result of the complications arising from the space restrictions due to the closed bite, we decided to use shaded IPS e.max® ZirCAD frameworks (Figs 1 to 4), which were then "pressed over" with IPS e.max® ZirPress (Figs 5 and 6) and then partially layered, as this technique offered the highest level of process safety. This decision was also taken as a measure to control the costs. Another aspect related to safety concerns was the decision to press IPS e.max ZirPress to the frameworks to full contour, because this ensures, on the one hand, that the required minimum thicknesses for pressing on zirconium oxide are met and, on the other hand, that all the functional relations in the glass-ceramics are precisely controlled.

By fabricating silicone keys, the reduction of the dentin cores and the subsequent build-up with IPS e.max® Ceram to the functionally checked shape is an easy and safe process (Figs 7 to 9). The patient requested layering with A2 materials – a rather untypical choice, considering the age of the patient (Figs 10 and 11).
I used an IPS e.max ZirCAD MO 0/B85 block for the framework (Fig 12). The possibility of integrating a support structure in the design of large-span constructions to prevent distortions during sintering is an interesting innovation of the Sirona inLab V.3.60 software (Figs 2 and 13). For this case, we shaded the frameworks with the IPS e.max ZirCAD Colouring Liquid CL 1 in the immersion technique (Fig 3). After three minutes, the frameworks were dried for two hours under an infrared lamp. Then, the frameworks were placed in the Programat S1 and the program 2 – sintering of bridges in 180 minutes – was started (Figs 14 and 15).

Fig 10 Mandibular bridge after glaze firing and polishing with diamond polishing paste

Fig 11 The completed maxillary bridge

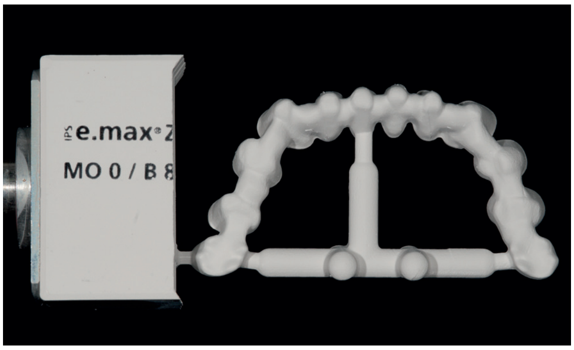

Fig 12 The IPS e.max ZirCAD MO 0/B85 L-22 block offers enough space for a 12-unit mandibular bridge.

Fig 13 Finishing by grinding the milled restorations is carried out by hand prior to sintering.

Fig 14 The frameworks are sintered in a vertical position on the sinter tray without a bead bed.

Fig 15 During the closing of the furnace chamber, the remaining sinter time of less than 180 minutes is displayed.

As the sintering process usually takes six to seven hours in other furnaces, it is hard to believe that the furnace head will actually open after such a short period. The exceptionally good and absolutely tension-free accuracy of fit of the two bridges (see Figs 3 and 4) is fantastic – and, as opposed to PFM restorations, this accuracy will not be compromised by subsequent firing cycles. I was given the opportunity to test a unique furnace. With this device, users finally have the possibility to carry out two to three sintering cycles in one day. In my experience, the fact that the objects are placed on a sinter tray without a bead bed does not have a negative effect on the accuracy of fit; on the contrary, I obtained restorations showing a very high accuracy of fit in every case. ❑

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