REFLECT

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Anterior tooth morphology, cut-back, shade and function

Symmetry and esthetics

Harmonious treatment of peg teeth

Dominance of the central incisors

All-ceramic crowns on endodontically treated central incisors

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passion vision innovation

Dear Reader

More than a year has passed since a devastating earthquake and tsunami struck the Tohoku area of Japan on 11 March 2011. While over 340,000 people remain displaced, the restoration of utilities and the construction of temporary housing are nearly finished. This has been made possible due to the generous support Japan has received from all over the world. Our utmost respect and gratitude goes to all those who are working untiringly to bring relief and recovery to the devastated area.

You will probably not hear much about the affected Tohoku area in the international news any longer these days. Even life in the big Japanese cities such as Tokyo has almost returned to normal. However, we will keep the memory of the Tohoku disaster alive in our minds. The devastation we have experienced has made us more aware of the value of bonds between people and led us to reflect on life, culture, community, technology and many other things in our daily lives.

Also at Ivoclar Vivadent, values are of utmost importance: "Passion – Vision – Innovation" is not just a tagline – we strive to live by these values every day.

In this issue of Reflect, we will introduce you to our latest innovations that are based on clinically proven products. They offer outstanding performance, reliability and esthetics and thus help you to achieve successful and predictable results.

This year is our 6th year of operation at Ivoclar Vivadent KK in Tokyo, Japan. One of the most important tasks we have focused on is to provide timely information that is particularly useful for clinical success. Reflect has fulfilled such a role.

I hope that you will enjoy reading this issue of Reflect and that it will provide answers to many questions that arise during your daily work at dental laboratories and clinics.

Yours sincerely

Kumazawa

Hideaki Kumazawa
Managing Director
Ivoclar Vivadent KK, Japan

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Predictable and esthetic

4-mm bulk fill in the posterior region

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Direct posterior composite resin restorations can be time consuming and technique sensitive, creating the need for a composite material that will simplify the procedure.

It has been accepted that achieving predictable and successful posterior direct composite resin restorations requires incremental placement and curing. This can be a taxing and difficult procedure because each layer presents an opportunity for failure if inadequately placed [1,2]. With the development of Tetric EvoCeram® Bulk Fill, a procedure once fraught with complications has become significantly less complicated.

Fig. 1 Preoperative view of old amalgam fillings and fractures in tooth structure

Bulk filled restorations require less chair time and are more predictable [3,4]. Due to specific material characteristics, Tetric EvoCeram Bulk Fill outperforms conventional composite resin and eliminates many of its disadvantages. Low polymerization shrinkage stress reduces microleakage, postoperative sensitivity and secondary caries [4-6]. Improved depth of cure eliminates the need for layering in 2-mm increments.

Specifically designed for bulk placement, Tetric EvoCeram Bulk Fill is formulated with two types of glass fillers with different mean particle sizes. Glass fillers tolerate posterior wear well and exhibit distinguished polishing properties [7]. The reactive polymerization booster enables dentists to place and cure the bulk-fill composite in a single increment of up to 4 mm in depth. Produced with a filler mixture consisting of glass fillers, ytterbium fluoride, mixed oxide and prepolymer fillers which features a refractive index coordinated with that of the shrinkage-reduced monomer mixture, Tetric EvoCeram Bulk Fill retains translucency and exhibits high radiopacity, achieving virtually invisible restorations indistinguishable from surrounding dentition.

The material and esthetic characteristics of the bulk-fill composite make it easy for today's dentists to achieve their goals of providing easy, esthetic and long-lasting posterior restorations.

latex rubber dam was placed, and the defective amalgam restorations were removed using a Sabre Cut #1557SC carbide bur (Fig. 2). The cavosurface margins were smoothed using a diamond bur, and the preparations were cleansed with an air abrasion system, then disinfected with a 2% chlorhexidine gluconate antibacterial scrub (Fig. 3).

Next, the completed preparations were measured with a periodontal probe, revealing a 5-mm depth (Fig. 4). A segmented matrix band with G-Ring was placed to ensure tight interproximal contact. The tooth was etched and bonded using a 37% phosphoric acid etch with an antimicrobial agent, re-wetted and disinfected with a 98% chlorhexidine diacetate hydrate for rehydration and inhibition of matrix metallo proteins (MMPs) (Fig. 5).

Fig. 2 A rubber dam was placed, and the amalgam fillings were removed.

Fig. 3 View of the completed preparations after cleansing, micro-etching and disinfecting

Fig. 4 Utilizing a periodontal probe, the preparation was measured to a depth of 5 mm.

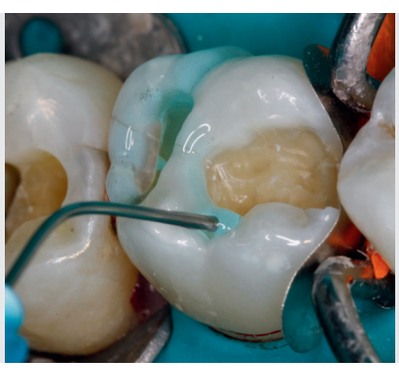


Fig. 5 A segmented band with G-Ring was placed interproximally and an acid etch was performed.

Fig. 6 An adhesive bonding system was applied, and the remaining ethanol solvent was evaporated using a warm air dryer.

Case presentation

A 50-year-old female patient presented with marginal leakage and a fracture in the tooth structure (Fig. 1), most notably the mesial marginal ridge of tooth 26 and the distal marginal ridge of tooth 27.

Shade IVB was selected for the dentin layer and IVW for the enamel layer, since the total preparation depth exceeded 4 mm. A single-component total etch adhesive was chosen as the adhesive bonding system (ExciTE® F), and OptraSculpt was the tool of choice for modeling and sculpting the composite material.

Clinical protocol

The patient was anesthetized with 2.5 ml of a prilocaine HCl solution with 1:200,000 epinephrine. A hygienic non-

A fifth-generation adhesive bonding system (ExciTE F) was applied, and the remaining ethanol solvent was evaporated from the adhesive resin utilizing a warm air dryer for 5 seconds (Fig. 6). A second coat of ExciTE F was applied and air dried for 5 to 10 seconds, then light-cured with the Bluephase® Style LED unit. Prior to placing the composite, the low viscosity resin Tetric EvoFlow® was used to seal the cleaned and etched grooves (Fig. 7).

Fig. 7 After light-curing the adhesive, the grooves were sealed.

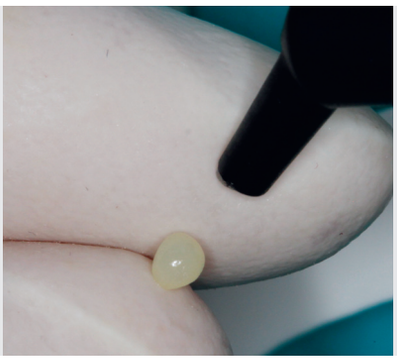


Fig. 8 A ball of composite was formed and placed in the preparation using the tip of a condenser instrument.

Fig. 9 The composite was moulded to cover the gingival seat of the interproximal box.

Fig. 10 The Tetric EvoCeram Bulk Fill composite in shade IVB was pushed into the uncured composite for bulk fill, after which the 4-mm increment was light-cured.

Fig. 11 Shade IVW of Tetric EvoCeram Bulk Fill composite was placed as the top 1-mm to 2-mm "enamel" layer of the composite.

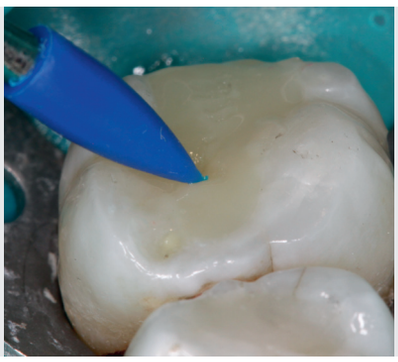
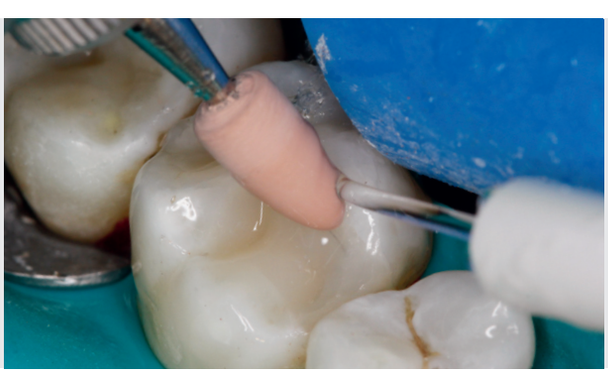


Fig. 12 View of the sculpted IVW bulk layer of composite

Due to the size of the preparation and the 4-mm indication for the composite material, the restoration was performed in two layers. A small ball of composite was formed (Fig. 8), carried on the tip of a condenser instrument and placed into the bottom of the interproximal box. This composite was fashioned into the gingival seat and left uncured (Fig. 9). To complete the 4-mm layer, Tetric EvoCeram Bulk Fill composite in shade IVB was pushed into the previously placed composite and smoothed with the OptraSculpt modeling instrument designed for use with composite materials (Fig. 10). This bulk increment was then light-cured for 10 seconds using the Bluephase Style. Tetric EvoCeram Bulk Fill composite in shade IVW was placed as "enamel" into the top 1 mm to 2 mm remaining, sculpted with OptraSculpt, and then light-cured for 10 seconds (Figs 11 and 12).

The restorations were then finished with carbide burs, a smooth diamond finishing bur and a Brownie point. A final polish was performed using a series of grey, green and pink Astropol® polishing points and Astrobush polishing brushes (Figs 13 and 14).



Figs 13 and 14 After the top layer of bulk composite was light-cured using Bluephase Style, the restorations were finished and polished with a selection of carbide burs and polishing points.

Fig. 15 View of completed restorations with rubber dam still in place

Fig. 16 Close-up image of completed direct posterior composite restorations after 24-hour rehydration

Conclusion

The face of dentistry continues to change with the development of innovative materials. Tetric EvoCeram Bulk Fill has simplified a procedure dentists worldwide perform numerous times a day, and in turn has saved them and their patients time and money. Characteristics such as a mouldable consistency enable fillings up to 4 mm, eliminating the need for layering and the technique sensitive characteristics of conventional composite procedures. Its strength provides long-lasting success, and its availability in three universal shades contributes to highly esthetic restorations that blend with natural dentition (Figs 15 and 16).

A literature list is available from the editors on request.

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How to build up the perfect tooth

Anterior tooth morphology, cut-back, shade and function

Ulf Krueger-Janson, Frankfurt am Main/Germany

A composite resin with ideal material properties can be used to create anatomically correct tooth contours and therefore lifelike dental restorations by using a suitable layering protocol.

The natural appearance of a tooth can be successfully reconstructed with a composite resin that is based on an integrated shade and layering system. Restorations of this kind blend in seamlessly with the natural dentition in accordance with biomimetic principles. Choosing the most suitable material for the task at hand is decisive for the successful outcome. The shade range of IPS Empress® Direct composite resin comprises five dentin materials in A shades (high opacity) and five matching enamel shades (high translucency). In addition, stronger as well as more translucent shades are available, some of which are opalescent, for designing the lateral enamel areas and incisal edges. This well-rounded range of shades and layering materials facilitates the creation of natural-looking restorations with composite resin. The following article describes the fabrication of a composite resin restoration in an anterior tooth using IPS Empress Direct. The procedure is described chronologically, starting with shade selection and ending with the final design adjustments.

Fig. 1 Preoperative situation: The unattractive composite build-up on tooth 11 needs to be replaced. The image is shown in greyscale to emphasise the shade nuances and the surface quality.

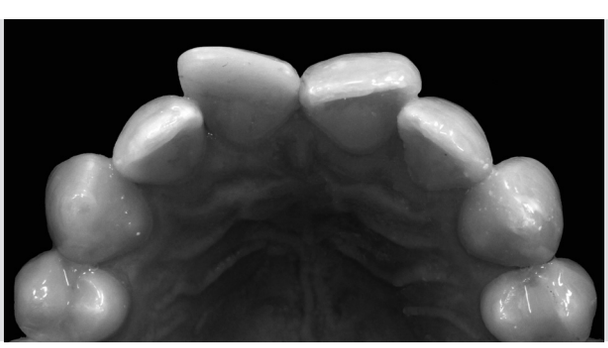


Fig. 2 Incisal view: Uneven vestibular contour. The neighbouring tooth 21 shows that in order for the tooth to appear lifelike, it needs to be positioned like a "butterfly wing".

Assessment of the preoperative situation

The appearance of the upper anterior teeth in the preoperative situation was unsatisfactory. Tooth 11 looked particularly unattractive. Neither its shape nor its shade satisfied the standards of a high-quality dental restoration. In order to obtain a clearer picture of the preoperative situation, a greyscale image was produced (Fig. 1). This image illustrates the insufficient brilliancy as well as lack of translucent areas. Furthermore, surface structures and their various transitions as well as wavelike white striations are visible. From the incisal aspect the vestibular

contour looks distinctly uneven (Fig. 2). As a result, the right incisor leans towards the labial aspect. The "wing effect" of the teeth in this particular case could not be reconstructed. Consequently, tooth 11 looks out of place.

The shade system of IPS Empress Direct comprises various dentin shades, which exhibit a high opacity. They are suitable for achieving bright effects (Bleach L/XL) or providing complete coverage (IVA5/A6). The system also includes matching enamel materials with more translucent Bleach and Incisal shades as well as shade components called Trans Opal (opalescent).

A straightforward method is available for gaining a general impression of the shade layers of the natural neighbouring tooth. Various shade samples of IPS Empress Direct are applied on the untreated enamel surface of the adjacent tooth – in this case tooth 21 – and polymerized (Fig. 3). Shade variations should be eliminated due to the polymerization process. The prepared tooth is then illuminated from various angles with the operatory light. As a result, the viewer gains a good idea of what the individual shades will look like in the mouth of the patient. The shade impressions obtained in this way provide the operator with valuable information regarding the shade behaviour of the composite resin system in use and the shades required for building up the restoration. In the present case, for example, the opalescent material Trans Opal was applied to the sides of the restoration in order to imitate the bluish-white areas of the natural adjacent tooth.

Build-up and layering of the basic shape

After the old restoration had been removed from tooth 11, the first increments were placed (Fig. 4). In order to imitate the saturated and intensive shade (opacity) of the neighbouring tooth, dentin shade A3 was placed at the base of the restoration. In addition, dentin and enamel shades A2 were applied in the incisal area. A lighter shade was required in the cervical region and therefore Dentin A2 layers were applied. Enamel A2 was placed on the sides (distal, mesial) of the restoration in order to impart more brightness to the tooth. Figure 5 clearly shows the different layers: The shade designations have been projected onto the image. Due to the dehydration of tooth 21,

Fig. 3 Individual shade samples from the composite range in use are applied to the neighbouring tooth 21 as a shade reference.

the shade had already changed compared with the samples shown in Figure 3. This serves as an important reminder that shade selection must be done very quickly, since the neighbouring tooth no longer provides a reliable shade reference once it is dehydrated. The built-up materials were covered with a coating of Flow A2 and the vestibular surfaces were created.

Tooth 11 was built up according to the described layering protocol. The aim of this step was to copy the shading of the neighbouring tooth and create the basic shape of the restoration (Fig. 6). The incisal area of this roundish tooth shape was difficult to recreate. The mesial edge was quite angular and only transitioned into the rounded body of the tooth towards the distal aspect. In this case, it was necessary

Fig. 4 After the removal of the old restoration, the layering process begins.

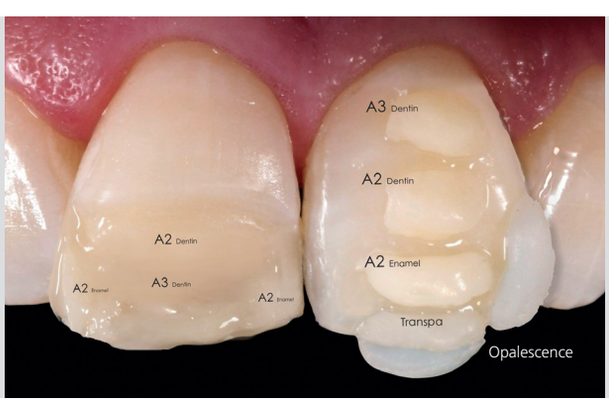
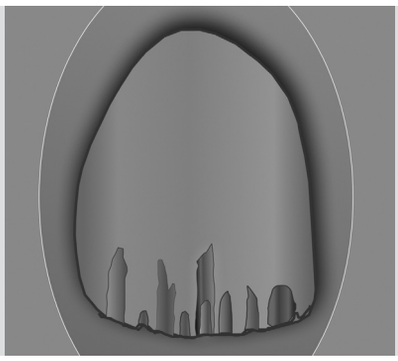


Fig. 5 The image illustrates the layering process; the shade designations have been projected onto the image.

Fig. 6 The basic shape and colour of tooth 11 have been recreated. The overall appearance corresponds to that of the adjacent tooth.



Figs 7 and 8 The cut-back technique involves grinding out mamelon-like grooves. Various depths and widths impart vibrancy to the structure of the restoration.

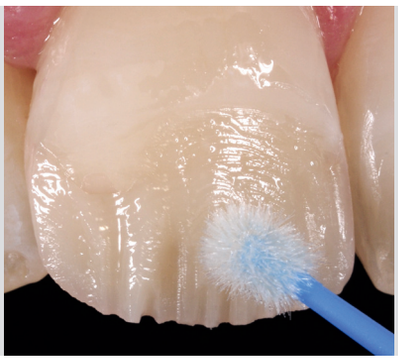


Fig. 9 The prepared surfaces are coated with a bonding agent.

to exaggerate the contours of this area when the composite was placed. This created ample scope for finishing the restoration. In all cases, the convex and concave areas have to be carefully finished. This task is often difficult to accomplish in the first attempt.

The best approach for reconstructing complex tooth shapes is to establish the basic shape with appropriately shaded layering materials and then to concentrate on important characteristics related to the shape and morphology.

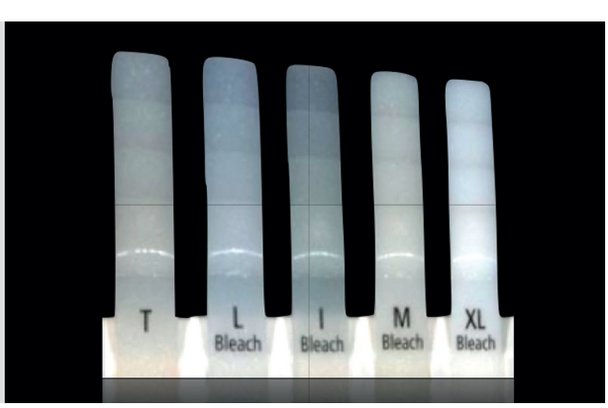


Fig. 10 The different shade values of the Tetric EvoFlow range from yellowish (Bleach I) to bluish (Bleach L). Bleach XL contains titanium oxide fillers and is therefore the most densely filled product.

The functional parameters are also taken into consideration in this process. This approach has shown to be very effective in routine practice work. If time is tight, for example, patients can be discharged with this type of "preliminary solution". The final layering procedure takes place at a later stage. Before the patient leaves the practice, however, the surface of the build-up should be coated with a flowable product in order to give the patient a comfortable feeling in the mouth.

Customized shading

The restoration build-up was completed with different shades from the range of composite resin materials. Mamelon-like depressions were cut into the surface of the preliminarily shaped and shaded restoration with a finisher (red code, fine grit) using the cut-back technique (Figs 7 and 8). The individual shade effects were inserted into these grooves at a later stage (inlay technique). The neighbouring tooth provided a mirror-image example. Various depths and widths imparted vibrancy to the structure.

The ground composite resin surface was coated with an unfilled bonding agent. Subsequently, the bonding agent was dispersed with air (Fig. 9) to prevent the accumulation of a thick layer of material in the marginal regions, which could cause an undesirable greyish transitional zone. The prepared vestibular tooth surface was filled with the selected flowable shades. The shades of Tetric EvoFlow® exhibit various whitish opacity levels. Different shade values ranging from yellowish (Bleach I) to bluish (Bleach L) are available. Bleach XL contains titanium oxide fillers and is therefore the most densely filled product (Fig. 10). The wide spectrum of shades enables fine shade nuances to be created. In the present case, the surfaces between the mamelons were filled, beginning with the deepest point. For this purpose, the flowable material was placed and then "pulled" into the areas needing to be filled with a probe tip. This procedure prevented the formation of bubbles. Various levels of opalescence were created (T, Bleach L, I, M, XL). If a highly translucent shade such as Bleach I is used, the grey value is increased to achieve a greyish "intermamelon area".

In order to illustrate the shade design more clearly, a shade map was projected onto the image in Figure 11. Finally, the restoration was coated with a flowable layer. In this case, Transpa (T) material was chosen. In situations where various shades are required to merge into each other, the flowable materials can be mixed with each other on the tooth surface. Nevertheless, close attention must be paid to preventing the inclusion of air bubbles!

Re-examination is important

One week after the completion of the restoration, the tooth was clinically evaluated and checked with regard to the

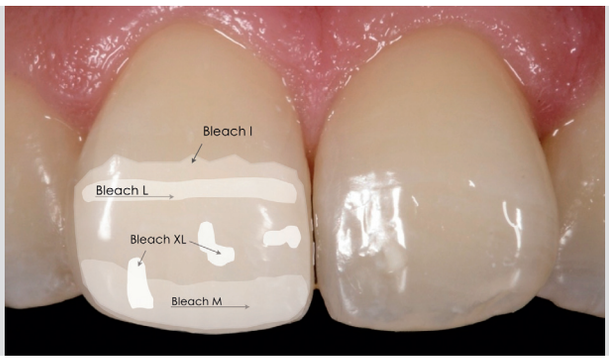


Fig. 11 In order to provide a clear indication of the shading process, the shade areas have been projected onto the image.

Fig. 12 One week after completion: Critical evaluation – a perfectionist may miss a bluish tinge in the incisal region. Nevertheless, the patient and the operator are completely satisfied.

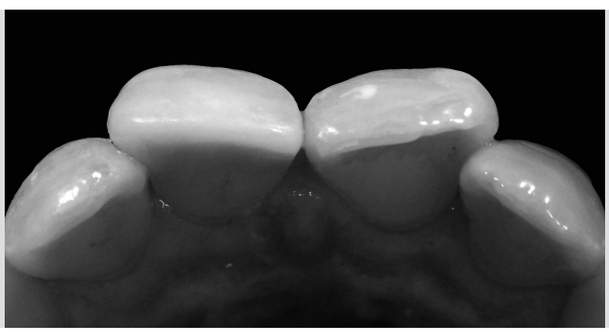


Fig. 13 The morphological integration has succeeded. The incisal view shows the natural-looking "wing effect" and a vestibular contour that is identical to that of the neighbouring tooth.

Fig. 14 Final evaluation of the composite build-up

adaptation of the shade to that of the surrounding natural dentition (Fig. 12). On closer inspection, very discerning operators may miss a bluish tinge in the incisal edge. If desired, however, this area can be optimized by cutting it back slightly and inserting Trans Opal to adjust the appearance.

The morphological integration of the restoration was successful. The view from the incisal aspect clearly shows the "wing effect" of the "butterfly teeth" and an even vestibular contour (Fig. 13), resulting in a natural appearance. The incisal-to-cervical curvature was adjusted with a file from the Eva System (KaVo). The final evaluation of the composite build-up was carried out by looking at the tooth from different angles (Fig. 14). The light reflecting bands at the sides are a reliable indicator of the proper anatomic shape of the restoration. These bands are responsible for the three-dimensional effect of the tooth. These side areas are created by a ridge that results from the transition between the vestibular surface and the interdental area. As shown in Figure 12, it is particularly important to round the distal side of "butterfly teeth".

Conclusion

The success of a composite resin restoration primarily depends on the appropriate reconstruction of the tooth morphology. Furthermore, the recreation of natural shade effects should be given equal attention. The resulting restoration will blend in smoothly with the surrounding dentition also in terms of biomimetics. In the case of complicated shapes, the contours of the neighbouring tooth should be copied as faithfully as possible. A three-dimensional design is a prerequisite for ensuring the overall integrity of the restoration. The incisal edge contours as well as the mesial and distal contacts are decisive to establishing the appropriate tooth shape. Modern materials allow discerning professionals to restore even very complex shade cases with composite resin layers. For this purpose, a composite that is available in true-to-nature shade components is requisite. The cut-back method simplifies the layering process, providing ample design freedom.

Ulf Krueger-Janson is the author of "3D Composites – Natural Shading & Shaping". The publication is available from www.teamwork-media.de or www.teamwork-bookshop.de.

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Symmetry and esthetics

Harmonious treatment of peg teeth

Dr Olivier Etienne, Strasbourg, and Dominique Watzki, Illkirch-Graffenstaden/France

Achieve the best possible outcome with as little effort as possible is a popular principle of economics that, if applied to dental medicine, translates as follows: Create an esthetic restoration with minimally invasive or non-invasive procedures.

Dental anomalies pertaining to the shape or the size of teeth may be symmetrical or asymmetrical. Often, such anomalies are seen on the lateral incisors, a condition for which the term "peg tooth" is generally used. In the past, various therapeutic approaches were suggested, including extraction of the tooth with subsequent orthodontic correction of the gap or placement of an implant-retained restoration. However, the advent of new possibilities in the area of adhesive cementation in conjunction with highly esthetic and high-strength glass-ceramics has given rise to an economically efficient and functionally sound alternative treatment.

Fig. 1 The young patient's smile before the dental treatment featured asymmetrical and peg-shaped lateral incisors.

Fig. 2 Preoperative situation, intraoral view. After the orthodontic treatment, the anterior tooth situation showed an inharmonious appearance with large diastemas. The relative position between the dental arches had been optimally observed (orthodontic treatment by Dr Jean Koch, Strasbourg).

Due to the restricted size of the bonding surface, the treatment of peg teeth requires the use of a high-performance adhesive system. Thus, in such cases, total etch systems are preferred over self-etch systems. In addition, it has to be ensured that tooth preparation is confined to dental enamel.

Clinical case

A 16-year-old female patient expressed the wish to have the esthetic appearance of her smile enhanced (Fig. 1). Her maxillary lateral incisors were peg-shaped, and she disliked the compromised appearance of her anterior teeth resulting from this. Orthodontic treatment had been initiated two years before, when it was decided that the peg-shaped teeth should be preserved (Fig. 2). Now the

time had come to correct the shape of teeth 22 and 12 using adhesively cemented all-ceramic veneers made of IPS e.max® Press lithium disilicate glass-ceramics.

Preparation

For reference purposes, an intraoral image taken from the labial aspect was digitally modified. This information allowed the dental technician to effectively plan the restoration and fabricate a wax-up accordingly, taking his envisaged outcome into account. In addition, the dentist was able to obtain a clear picture of how to modify the gingiva. Prior to the subsequent treatment appointment, the model together with the wax-up was recorded in the form of a silicone key and transferred to the mouth according to the method developed by G. Gürel (Fig. 3). The silicone key was filled in the area of the lateral incisors with Telio CS C&B, a self-curing, temporary crown and bridge material for the fabrication of temporary restorations, and then inserted in the mouth (Fig. 4). After the curing time of two minutes, the impression was removed and the restorative "preview" was shown to the patient. Both the patient and the dentist were satisfied with the defined shape of the lateral incisors. We then created depth marking grooves through the composite masks (Figs 5 and 6) to ensure that as much dental enamel as possible was preserved, as this is also conducive to the quality of the bond that is achieved. These grooves served as reference points throughout the preparation process. We also made minor gingiva modifications during the same appointment in order to achieve a harmonious and esthetic emergence profile (Fig. 7).

After a healing phase of one week, we took the impressions for the fabrication of the master model and the final

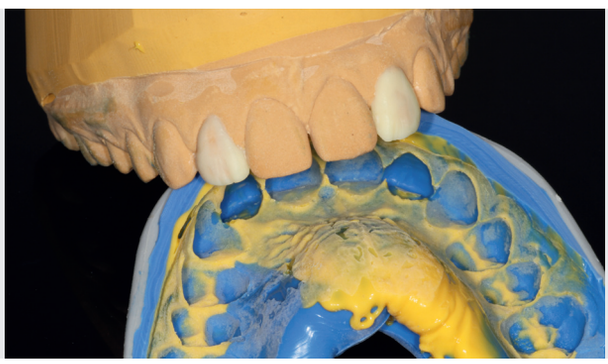

Fig. 3 The wax-up as modelled by the dental technician. This wax-up was used for the planning of the gingiva modifications.

Figs 4 to 6 Controlled preparation through the esthetic mock-up is a prerequisite to ensure that the permanent restoration is only cemented on dental enamel. This improves the quality of the cementation and gives the restoration a more esthetic appearance in the long term as compared with restorations cemented only on dentin.

Fig. 7 The extent of gingiva modification was kept to a minimum but was indispensable in order for the desired esthetic outcome to be achieved.

Fig. 8 The veneers fabricated by the dental technician

Fig. 9 The situation directly after seating of the veneers

Fig. 10 One week after seating, the result was excellent with regard to both function and esthetics.

restorations. The dental technician produced two veneers made with IPS e.max Press material in the shade LT A1. In terms of shape and size, the wax-up served as a reference (Fig. 8).

Cementation of the veneers

The two veneers were tried in with yellow-shaded and transparent glycerine gel (Variolink® II Try-In pastes). We decided to use a mixture of both materials to create a harmonious transition between the canines (showing a high shade saturation) and the very bright central incisors.

In this case, we chose the dual-curing composite system Variolink II and the adhesive ExciTE® DSC for the cementation of the veneers. We removed gross cementation material excess after polymerizing it for three seconds in the "Soft" mode of the curing light. The fine excess was removed after final polymerization in the "High" mode (Fig. 9).

After one week, the patient came to the practice for another appointment. Everybody involved was completely satisfied with the outcome (Figs 10 to 13).

For such very delicate and thin restorations to be cemented according to the best practice in dental medicine, the operation field should always be isolated with a rubber dam.

Figs 11 to 13 The patient's "new" smile will last a long time. A very favourable prognosis could be made, because the materials used have proved their clinical suitability.

Conclusion

The lithium disilicate crystals contained in IPS e.max Press impart the material with good properties which enable you to fabricate highly esthetic restorations: mechanical strength, compatibility with veneering ceramics and excellent optical properties. If we combine the material with a total etch cementation system such as Variolink II, we can confidently look forward to any future cases involving adhesively cemented ceramic restorations.

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Dominance of the central incisors

All-ceramic crowns on endodontically treated central incisors
Dr Jan Hajtó and Stefan Frei, MDT, Munich/Germany

Lithium disilicate ceramics offer dental professionals, for the first time, the opportunity to use a material that combines high strength with natural translucency.

Discoloured teeth are often the result of endodontic treatment. Although metal-ceramic crowns may cover even severely discoloured tooth structure, the metal frame often causes the areas beneath the crown margins to appear dark. The framework does not allow light to pass through the remaining tooth structure and the dark margins of the metal substrate show up in the visible area even if only minimal gingival recession occurs. Since metal-ceramic restorations have been the standard in dental restorations, including anterior crown reconstructions, for several decades, many patients have come to regard these dark rims as the inevitable consequence of "tooth crownings". All-ceramic materials, and especially translucent glass-ceramics, offer all the esthetic advantages required for anterior restorations, but they are often associated with limited strength. Lithium disilicate presents a material that, for the first time, combines high strength with natural translucency. The following case report highlights the strengths of IPS e.max® Press.

Preoperative situation and treatment planning

A 40-year-old female patient required a functional overhaul of her dentition, including an increase in the vertical dimension. In addition, the two existing metal-ceramic crowns on the central incisors were in need of replacement. The patient was bothered about the clearly visible dark areas beneath the crown margins. The gingival tissues looked slightly bluish on the cervical side of the crowns, which was an indication of discoloured underlying tooth structure (Fig. 1). An X-ray examination revealed an inadequate root canal filling on tooth 21.

Fig. 1 Preoperative situation: existing metal-ceramic crowns on teeth 11 and 21. In addition to the dark crown margins, the bluish discoloured gingiva on tooth 21 caused dissatisfaction.

Fig. 2 In the wax-up we established a crown shape that was characteristic for the patient and created an optical distraction from the slightly flawed gingival esthetics.

Tooth 11 had not previously been treated endodontically, yet it did not show any signs of sensitivity when it was exposed to vitality testing. Since the central incisors play an essential part in the esthetic appearance of the anterior region, even straightforward cases like this necessitate a careful approach to planning. Creating a wax-up in the run-up to implementing the restoration is required even, or especially, for cases that involve only one or two incisal crowns. In the present case, the existing crowns did not match the characteristics of the patient well. Our aim was to find a more expressive and daring shape to optically distract from the shortcomings of the gingival esthetics. The central papilla in particular was somewhat too short. We therefore decided to use a triangular shape for the crowns (Fig. 2).

After the existing crowns had been removed, the shape of root canals showed that the teeth must originally have been in a severely protrusive position and the remaining tooth structure had been heavily cut on the labial side to amend this position. As a result, tooth 11 showed long standing damage to the pulp cavity with a symptomless necrotic pulp, which required endodontic treatment. Both root canal systems were discoloured to different extents (Fig. 3). Such discolouration can usually be easily brightened up by internal bleaching. However, if this step is performed, a tight root canal filling is indispensable to protect the periapical tissue from contact with the bleaching agent. Tooth 11 was endodontically treated and the existing root canal filling of tooth 21 was revised. Subsequently, both root canals were obturated with liquid gutta percha (Figs 4 and 5).

As the remaining tooth stumps were very short and we had to ensure appropriate retention of the temporaries, we decided to rebuild tooth 11 with a glass fibre post and an adhesive composite build-up (Tetric EvoCeram®). Figure 6 shows tooth 21 after the endodontic treatment, bleaching with sodium perborate and 3% hydrogen peroxide and adhesive post build-up.

Subsequently, the tooth stumps were subjected to external bleaching with 30% hydrogen peroxide whilst a rubber dam was in place to whiten the relevant areas beneath the crown margin. After this process, the tooth structure was bright enough to act as substrate for the translucent glass-ceramic IPS e.max Press restorations (veneered with IPS e.max® Ceram). Because we used post build-ups, we were able to prepare an ideal circular reduction of approx. 1 to 1.5 mm. This provided the technician with sufficient space to create an individualized veneer.

Indirect temporaries

The splinted direct temporaries were esthetically not satisfactory. We therefore decided for lab-fabricated provisionals as a prototype restoration. These restorations do not represent a classic "long-term temporization", because they allow the esthetic, functional and periodontal integration of the restoration to be evaluated already after a few days or weeks. Without this intermediate step, the final outcome would have been subject to many more variables, especially because we were trying out a somewhat more daring tooth shape in this case. It is crucial that the temporaries and final restorations are created by the same person. This is not the case if direct temporaries are used.

Fig. 3 Situation after removal of the crowns, cleaning of the remaining tooth structure and post extraction on tooth 21

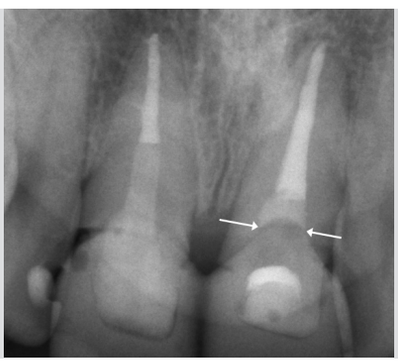


Fig. 4 X-ray examination after root canal obturation and glass fibre post insertion in tooth 11 and revision of 21; the root canal filling was covered with a glass ionomer cement before internal bleaching (3% H_2O_2 and sodium perborate) was applied.

Fig. 5 Direct temporary. The shape still resembled that of the previous crowns.

Fig. 6 Result after the endodontic treatment, bleaching and adhesive post build-up. Both teeth had been additionally whitened from the labial aspect whilst a rubber dam was in place and tooth 21 also received a glass fibre post.

If possible, the lab-fabricated temporaries are not splinted. The patient was satisfied with the provisional result, as shown in Fig. 7. However, it turned out that these crowns were slightly too long, resulting in premature contacts during extreme protrusive movements. This inconvenience was easily eliminated on the temporaries before the final crowns were fabricated.

Crown fabrication

Since our aim was to cover the discoloured dark cervical area of tooth 11 and to achieve a maximum level of brightness in both crowns, we opted for an IPS e.max Press framework based on an MO ingot (MO = Medium Opacity). The medium opacity was chosen to prevent the crowns from absorbing too much incident light and therefore to avoid that they would appear greyish. Enough space was available to adhere to the stipulated minimum thickness of 0.6 mm without difficulty. To ensure that the stipulated maximum layer thickness of the IPS e.max Ceram layering ceramic was not exceeded, the dimensions of the framework were designed as large as possible using the high-strength lithium disilicate glass-ceramic (Fig. 8).

The dentin body was built up with ceramic materials of various intensities using a palatal matrix as an auxiliary (Fig. 9). Opalescent incisal materials were used to extend the core and characterizations were applied with mamelon materials (MM yellow, MM light). The shape was completed with Incisal and Opal Effect materials (TI 1, OE1, OE2).

Customized shade matching of anterior restorations should be performed by the dental technician. The technician establishes a detailed layering diagram for the crown to achieve an individualized result in the course of the shade selection appointment.

Fig. 7 The lab-fabricated temporaries at the try-in. A dark retraction cord is shining through the gingival margin of tooth 21.

Figure 10 shows the complete anterior and sagittal layering diagram with the ceramic materials used. After the restorations had been fired and reworked, minor adjustments were implemented and then the crowns were prepared for glaze firing.

Adhesive crown cementation

The restoration met with a high level of acceptance from the patient at the try-in. If possible, we avoid the temporary seating of all-ceramic restorations because we feel that the risk of causing a fracture during the removal is too high. It is important to allow the patient ample time to assess the crowns under different light conditions (i.e. day light in particular).

Adhesive cementation was performed with Multilink® Automix. The internal surfaces of the crowns were cleaned with Ivoclean after the try-in to remove any residual saliva. Then these surfaces were silanized with Monobond® Plus. The tooth preparations were meticulously cleaned and roughened by blasting with 50 µ aluminium oxide corundum. This step also increases the wettability of the surfaces, facilitating the application of the two-component primer (Multilink Primer A&B). The primer improves the curing performance of the luting composite.

Fig. 8 The frameworks were fitted on the model and adjusted. After wash firing and individual characterization (Essence materials), they were prepared for the application of the veneering ceramic.

Fig. 9 Dentin layering (Dentin A2 and A3)

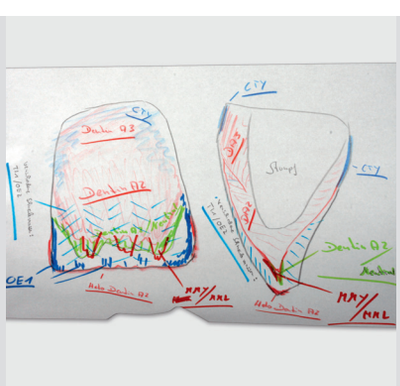


Fig. 10 Layering diagram established by the dental technician

Fig. 11 The restorations were polymerized from all sides for a few seconds to facilitate the removal of surplus material.

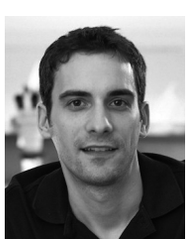
Fig. 12 Excess removal with a pointed probe

Fig. 13 The treatment result at the check-up. The dark shadow above tooth 21 has completely disappeared.

Multilink Automix was applied in a homogeneous, bubble-free layer directly into the crown by means of a mixing tip. After the crown had been seated, the excess material was polymerized for a few seconds (Fig. 11) and effectively removed (Fig. 12). Multilink Automix is a self-curing material that offers the option of light-curing to speed up the polymerization process in conjunction with translucent crowns. All residual material should be meticulously removed when an adhesive cementation method is used.

Conclusion

IPS e.max lithium disilicate results in true-to-nature esthetic results. The IPS e.max Press material is selected in an appropriate degree of opacity and translucency in line with the shade of the remaining tooth structure, the target shade and the given indication. Dental technicians who have been using other ceramic systems may have to adjust their routines slightly when they begin to use the IPS e.max Ceram layering ceramic. From our own experience, however, we can affirm that it is worth changing over to this new all-ceramic system and to take advantage of this convenient combination of press and layering materials as well as to gain more knowledge about this technique in educational courses. Ceramic fractures of elaborate restorations are always a nuisance and take the joy out of esthetic dentistry. It is therefore advisable to use a material such as lithium disilicate which offers both high strength and exceptional esthetics. The translucency of this ceramic allows the light to pass through the restoration to the root, avoiding gingival shadowing (Fig. 13). As a result, our artificially produced tooth replacements resemble the natural dentition even more closely. The most grateful of all are, however, our satisfied patients.



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Esthetic veneers – minimally invasive and conservative

Esthetically exacting restorations using IPS Empress® Esthetic

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Orthodontic pre-restorative treatments can sometimes put a patient's patience to the test. Lingual brackets in conjunction with a labial impression technique can shorten the treatment time.

A 29-year-old patient came to my clinic to have her discoloured teeth in the upper and lower anterior dentition treated. She wanted laminate veneers, as the discolourations had not improved even after several tooth whitening procedures. Another problem was related to severe crowding and malocclusion of the teeth. These conditions had to be treated orthodontically prior to the prosthetic restorations (Figs 1 to 3). The patient was therefore referred to an orthodontist for preliminary treatment.

Although the orthodontic treatment had not been concluded yet, the patient came to the clinic again after six months and strongly urged us to provide her with laminate veneers to improve her esthetic appearance.

Figs 1 to 3
The patient's severely crowded and malocclusion teeth required orthodontic treatment prior to the restorative treatment.

Figs 4 and 5 After six months of orthodontic treatment, the patient's patience had worn thin. She requested permanent restorations. The images show the initial situation.

Usually, treatment with laminate veneers is only indicated after orthodontic treatment has been concluded.

After intensive discussion with all parties involved and after having contemplated all the technical and medical options, we found a way to meet the patient's most urgent wish and provide her with laminate veneers already during the orthodontic treatment after all (Figs 4 and 5).

Preparation and provisionalization

As the patient had received orthodontic treatment in the form of lingually attached brackets (Fig. 6), the impression was taken in this case from the labial side with an individual tray. By using an individual tray, we were able to, by and large, avoid interferences caused by the brackets (Fig. 7).

To evaluate the functional and esthetic possibilities, we fabricated a wax-up. A silicone key was created on top of the wax-up on the model. This key then served as a guide to ensure sufficient reduction during veneer preparation (Fig. 8). Figures 9 and 10 show the preparations in detail.

Fig. 6 The lingual brackets allowed for preparation and impression-taking from the labial aspect.

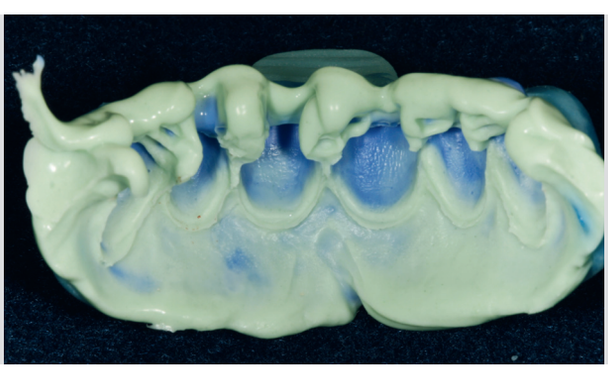

Fig. 7 Silicone impression with an individual tray from the labial side

Fig. 8 Dimensional requirements as determined by means of the silicone key

Figs 9 and 10 The final preparations in detail

Fig. 11 Acrylic provisional veneers in situ

Fig. 12 Final IPS Empress Esthetic veneers on the model

At the same time, a provisional restoration was fabricated in acrylic material based on the wax-up (Fig. 11). The accuracy of fit was optimized by means of intraoral relining. We added acrylic resin material to the lingual and the interdental areas to retain the provisional veneers in place.

Fabrication of the final restorations

As the determined tooth shade was A1.5, we decided to use the leucite press ceramic IPS Empress Esthetic in the shade ETC1. This material is particularly suitable for very bright shades or after tooth whitening procedures. IPS Empress Esthetic ingots generally show a lifelike light scattering pattern and offer a balanced chameleon effect. These ingots are available in a total of twelve ingots that feature seven different translucency levels and are used to fabricate single-tooth restorations (veneers, inlays, onlays, partial crowns, anterior and posterior crowns).

The veneers were pressed according to the fully anatomical wax-up. In order to design natural-looking mamelon structures, the incisal third was reduced. We applied IPS Empress Esthetic veneer Wash pastes (Modifier Sky Blue, MM yellow-orange, MM reddish-orange, high value and others) and fired them at 650 °C (1202 °F) in order to imitate the internal characteristics in the area of the incisal third. Subsequently, the veneers were covered with IPS Empress Esthetic Veneer Incisal Opal LT, MT, HT and Incisal White, Orange and other layering materials and then fired. Given the young age of the patient, we did not include any abrasion marks in the incisal area and on the surface texture. After glaze firing, the surface characteristics were designed by means of silicone polishers. After that, the veneers were polished using diamond paste (Fig. 12).

Finally, we applied Variolink II Base (transparent) and light-cured it to seat the veneers. Figures 13 and 14 show the treatment outcome, with which the patient was more than satisfied. The orthodontic treatment of the patient then went on for another twelve months.

Fig. 13 The veneers (tooth shade A1.5) in situ

Fig. 14 The smile line as viewed slightly from the side

Fig. 15 The situation at a follow-up after three years

Follow-up

The long-term outcome is of particular interest to any treatment team for obvious reasons. After completion of the orthodontic treatment, therefore, fixed lingual wire retainers were applied in order to stabilize the new position of the mandibular and maxillary anterior teeth. Figure 15 shows a photograph taken at a follow-up appointment after three years.

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