REFLECT

dental people for dental people 02/11

The three pillars of esthetics
Directly placed composite restorations using IPS Empress Direct®

An impressive outcome
Restoring severely discoloured anterior teeth using minimally invasive procedures

New ways have to be taken sometimes
Veneer restorations layered onto pressed ceramic substrates

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Editorial

Dear Reader

One of Ivoclar Vivadent's major objectives has been, and continues to be, the launch of newly developed technologies on a worldwide scale – ideally in all countries at the same time. To make new products available to the dental profession throughout the world is a very challenging task. It demands considerable effort on the part of the people involved in Research and Development, Production, Logistics as well as in Marketing and Sales. The effects of globalization which now involve all levels oblige us to continually adjust our plans of action to be able to meet the new demands with which we are faced.

Everywhere in the world, Ivoclar Vivadent products enjoy a reputation for being of extremely high quality – and this also applies to Latin America. Our unflagging commitment to meeting, or even exceeding, customer expectations has certainly helped to achieve these results. However, the worldwide distribution of products is not our only concern. We organize as well as endorse and financially support further education events and training courses in order to ensure that our customers have the latest information at their fingertips as far as state-of-the-art techniques and treatment modalities are concerned that help achieve esthetic and durable restorative results. The same rationale lies behind our efforts to provide the dental community with scientific reports, research results and case report by means of publications such as Reflect magazine.

We hope that the articles contained in this issue of Reflect will serve exactly this purpose and that you, the readers, may derive benefit from it for your practical work. The best results are achieved in practice if operators have undergone comprehensive training. This helps to ensure that they use the products according to the instructions and recommendations, which we as the manufacturer make available to them.

With best wishes

German Sarmiento
General Manager
Ivoclar Vivadent Colombia

The cover picture shows an agate slab with amethyst, which exhibits an opalescent effect similar to that of natural tooth structure under fluorescent light (Photo: Eva Ilzer).

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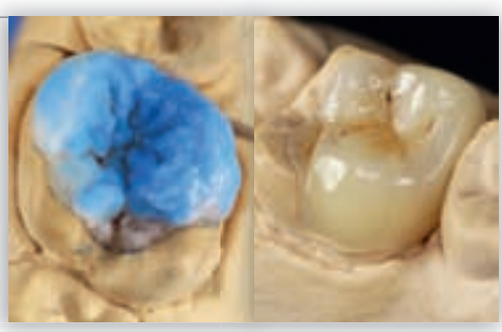
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All filling materials are not alike

The first choice for posterior restorations

Dr Eduardo Mahn, Jeddah/Saudi Arabia

Glass ionomer cements (GICs) and composite resins have been successfully used for a variety of indications in direct filling procedures for many years. Both materials are considered to be excellent amalgam alternatives, even though they both have their respective strengths and weaknesses. Over time, the spectrum of their applications has grown wider and more sophisticated.

Glass ionomer cements

Glass ionomer cements chemically bond to the tooth structure and release fluoride over a period of time. Moreover, they are easy to use and biocompatible. GICs are composed of polyalkenoic acid and glass powder, mainly aluminium fluorosilicate glass. An initial acid-base reaction occurs when the powder and liquid are mixed. A salt gel matrix is formed and a completely cross-linked structure results, which assists in the setting of the cement [1,2].

Conventional glass ionomers were introduced in 1972 [3], followed by metal-reinforced glass ionomer cements, containing either silver or gold, in 1977 [4]. Resin-modified glass ionomer cements were developed in 1992 [5, 6]. Current research efforts are focused on using acids with a high molecular weight, which would heighten the viscosity of the product and accelerate curing.

The applications of GICs range from cementation and lining procedures to the placement of Class V restorations and small deciduous tooth fillings. Nevertheless, it is important to note that the adhesive strength of glass ionomer cements is relatively low (merely 3 to 7 MPa) [6,7]. Furthermore, the problem of marginal integrity and marginal seal must also be taken into consideration. Even though GICs demonstrate a thermal coefficient of expansion similar to that of natural tooth structure [1,6], glass ionomer fillings often show marginal leakage. A number of studies have found that composite resins achieve more successful results with regard to marginal integrity than GICs in dental enamel [8].

The most important characteristic of GICs is most probably their ability to release fluoride. This action begins when the components are mixed and continues gradually without negatively influencing the mechanical properties of the material [9]. Moreover, GICs are capable of absorbing topically applied fluoride and releasing this component over an extended period of time [10]. Therefore, GICs are considered to have a cariostatic effect in clinical use [11]. Nevertheless, carious lesions are often found along the margins of GIC restorations. The ability of GICs to release an adequate amount of fluoride to successfully inhibit the growth of caries has not yet been established. The service life of GIC restorations is a further cause for concern. Numerous studies have shown that the life time of these restorations is considerably shorter than that of composite resin and amalgam restorations. Therefore, GICs are more appropriately used in the fabrication of long-term temporaries than permanent restorations. A systematic analysis has shown that the failure rate of GICs is above seven percent, while that of composite resins is lower than three percent [12].

Despite these drawbacks, many practitioners are tempted to use GICs rather than composite resins as an alternative to amalgam. GICs are easier to use and their application protocol is faster than that of composite resins. Furthermore, they are much cheaper and therefore very popular in emerging markets.

Composite resins

As a result of developments in the field of composite resins, as regards the inorganic fillers [13] and monomers used [14] in particular, these materials now feature lower solubility and higher wear and fracture toughness. Therefore, the overall mechanical properties of composite resins have improved. The interaction of the bonding agent and the tooth structure establishes micromechanical retention [15-17], which ensures a high level of resistance.

Fig 1 Preoperative view

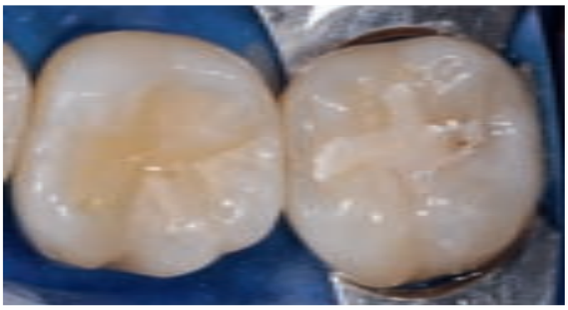
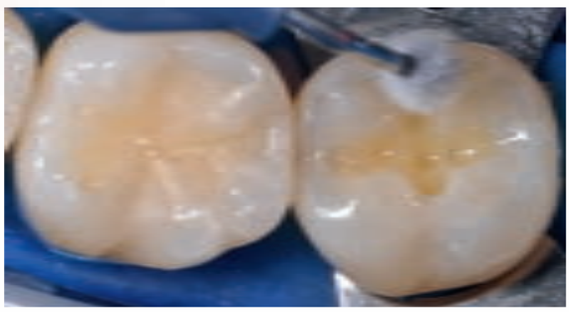


Fig 2 Proper isolation of the operative field with a rubber dam



Figs 3a and b Application of the self-etching adhesive for 30 seconds

Today, composite resins have only two shortcomings compared with glass ionomer cements: They take longer to place and the application protocol is more technique sensitive. This time difference, however, is not really significant if the entire restorative procedure is taken into consideration: examination, diagnosis, anaesthetic, excavation, preparation, isolation and finishing and polishing. The development of self-etching adhesives – irrespective of one-step or two-step systems – has reduced the entire treatment time quite considerably. The introduction of self-etching adhesives has also helped to reduce technique sensitivity and increase the reproducibility of results [18]. The dentin tissue is not etched and the smear layer is not removed; instead, infiltration takes place. As a result, the dentin tissue is easy to dry and post-operative sensitivity is reduced [19]. Furthermore, the evaporation of the solvent after the application is not a critical issue. As is the case with many total-etch adhesives, a mixture of different solvents, rather than just one, is used. In this context, it is important to note that strong adhesion to dental enamel can only be achieved with phosphoric acid etching [20,21]. This step is always recommended, regardless of the method used.

In the following case study, a self-etching adhesive of the latest generation was used (Tetric® N-Bond Self-Etch). Due to its innovative pen-shaped delivery form, this material can be directly applied, which saves time. Despite all of these advances and developments, however, composite resin users must have in-depth knowledge of materials. The procedure recommended by the manufacturer must be strictly observed.

Case study

A 31-year-old female patient presented to our surgery after a lengthy absence. A thorough examination revealed that several aspects required attention, in particular a highly opaque, damaged filling in tooth 47. The filling in question had the distinct appearance of a glass ionomer cement. Secondary caries had formed in the distal area. According to the patient, it had been placed less than two years previously. Furthermore, we took note of a filling in tooth 46 that had been placed in our surgery more than eight years ago (material: Tetric® Ceram). The restoration was clearly worn after all this time. Nevertheless, the margins were still intact (Fig 1).

We recommended that the filling in tooth 47 be replaced. Figure 2 shows the working field isolated with a rubber dam (OptraDam® Plus). Proper isolation ensures clean and safe placement of the restorative material. The old filling was removed and carious tissue was excavated. An adhesive (Tetric N-Bond Self-Etch) was placed directly on the tooth structure and scrubbed in for 30 seconds (Figs 3a and b). The solvent was evaporated with a strong stream of air. Next, the surface was light-cured for 10 seconds with a third-generation LED polymerization unit (bluephase®).

First, a layer of flowable composite resin (Tetric® N-Flow) was placed in the cavity (Fig 4) and light-cured for 10 seconds. Subsequently, the filling was built up with shade A2 of the universal composite resin Tetric N-Ceram®. A non-stick modelling instrument (OptraSculpt®) was used, with which the cusp slopes and tips were faithfully reproduced. This instrument is supplied with various

Fig 4 Application of a flowable composite resin as the first layer

Fig 5 View of the distal cusps after light-curing

Fig 6 Sculpting of the mesial cusps

Fig 7 Occlusal view of the filling before polishing

Fig 8 Final polishing in one step with a large "flame" tip

Fig 9 Result of the occlusal inspection

working tips to satisfy the different indications. In the present case, the chisel shape was used. The pointed end of the tip was used to sculpt the fissures.
The restoration was built up in four steps. One cusp was modelled and light cured at a time. Figure 5 shows the situation after the distal cusps were polymerized. In Figure 6, a mesial cusp is sculpted. Only as much composite resin as was necessary was applied and light-cured. As a result, very few occlusal adjustments were necessary. Figure 7 shows an occlusal view of the filling before polishing. The natural-looking anatomy is clearly evident as well as the worn eight-year-old filling in tooth 46 and its intact margins. After occlusal grinding, the restoration was polished with OptraPol® Next Generation rubber tips (Fig 8), which contain a high diamond crystal content (72 wt%). This high diamond content achieved excellent polishing results in only one step.

Figure 9 shows the finished filling with the marked contact points. ❑

A bibliography is available from the editors on request.

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The three pillars of esthetics

Directly placed composite restorations using IPS Empress Direct®

Dr Julio Reynafarje Reyna and Dr Gustavo Watanabe Oshiro, Lima/Peru

How often do we encounter heavily stained anterior teeth in dental practice? Nearly every clinician has come across that problem at least once. In such cases, an invasive approach is usually required, ie the teeth need to be prosthetically restored with ceramic veneers or even crowns. However, since the concept of "minimal invasiveness" has attained quite a following recently, it might be a good idea to start rethinking our ways of dealing with stained anterior teeth. Today's state-of-the-art composites enable dental professionals to use minimally invasive treatment protocols and achieve outstanding restorative results.

Training courses held on the subject of esthetic dentistry usually focus on three basic aspects: shape, shade and surface texture. These are the three indispensable pillars without which the esthetic restoration of anterior teeth would be impossible. However, in most cases attention is only paid to one of the aspects, namely shade. Why is this so? This article will show how all the three elements can be taken into account in order to achieve an esthetic outcome.

Preoperative situation

A female patient presented to our dental practice with a stained central incisor (Figs 1 and 2). She refused to have the tooth prosthetically restored with ceramic material and expressed her desire to receive minimally invasive treatment. We decided to apply a direct restorative technique using state-of-the-art composite resin (IPS Empress Direct).

Initial steps and tooth preparation

As the degree of tooth discolouration varied from mild to medium, a preparation depth of 0.3 to 0.5 mm was sufficient. Following minimally invasive preparation, a retraction cord was placed to prevent contamination of the working field with sulcus fluid (Fig 3). When fabricating layered restorations, the application of the adhesive is the step most prone to error. Therefore, it is advisable to use an adhesive system that is easy-to-use, but provides reliable adhesion. In the case presented, we decided to use ExciTE® F adhesive. After having conditioned the enamel with phosphoric acid gel (Total Etch) for 30 seconds, the adhesive was brushed into the tooth structure for 10 seconds (Fig 4) and blown to a thin layer with a weak stream of air. Subsequently, the adhesive layer was light-cured for 10 seconds with the bluephase® curing light using the Low Power mode. Then the first composite layer was placed. In order to achieve optimum masking, we chose to use the opaque B2 shade from the IPS Empress range of Dentin materials.

Fig 1 Starting situation: severely stained tooth 11

Fig 2 A close-up of the upper anterior teeth shows that the esthetic appearance is inadequate.

Fig 3 Situation after minimally invasive preparation of the tooth

Fig 4 The adhesive was brushed into the tooth structure for 10 seconds.

Fig 5 In the gingival portion, composite was applied in an "arch" shape to follow the gingival outline (B2 Dentin).

Fig 6 The composite was adapted to the natural tooth structure.

Fig 7 Placement of composite in the proximal portion of the tooth. Also in this region, an "arch" was moulded.

Fig 8 Shade A1 Dentin was chosen for the central portion of the tooth (mamelon area). The incisal edge was covered with translucent opalescent material.

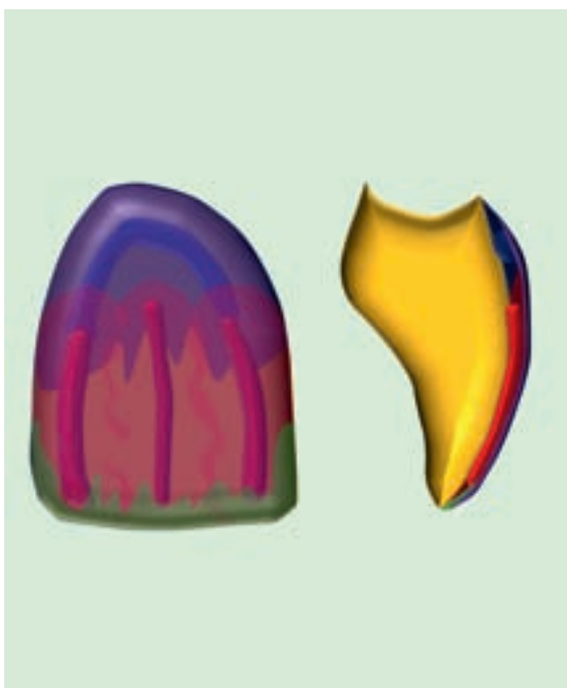

Fig 9 Layering scheme showing the masking composite layers

Fig 10 Application of the enamel layer (B1 Enamel)

Fig 11 Final polishing of the restoration with the Astropol system

Figs 12 and 13 The final result: esthetic reconstruction of tooth 11 involving minimum loss of tooth structure

Layering

Mimicking the shape and shade of natural teeth is a huge challenge and requires considerable attention to detail. In order to achieve the same reflections as those of natural teeth, the dentin shade was applied in an arch-like fashion. As the composite material readily adapted to the preparation margins, only light pressure with the modeling spatula (Fig 5) had to be applied. The composite increment was deliberately moulded with a slight taper towards the centre of the tooth. In this way, an invisible transition to the subsequently placed increments was ensured (Fig 6). Then the composite was light-cured with the bluephase curing light for 15 seconds using the Soft Start mode.

After having moulded the gingival "arch", which outlined the gingival margin of the veneer, the proximal portions were moulded in a similar fashion. As each layer was thinned out, the different shades and shapes blended well into each other (Fig 7). Once the mamelon-type increment had been placed in the centre, the discolouration was completely masked. Both in the proximal and central areas, Shade A1 Dentin was used. To copy the appearance of the adjacent teeth, a translucent opalescent material was applied along the incisal edge. Finally, the entire composite build-up was covered with a layer of IPS Empress Direct B1 Enamel as indicated in the layering scheme (Figs 8 to 10).

Finishing

In order to closely reproduce the morphology and anatomy of natural teeth, just as much effort should be applied in finishing the restoration as in layering it. Following polymerization, attention was paid to creating an optimal surface texture. First, the restoration was pre-contoured with fine-grit burs to remove possible composite excess. Fine-grit instruments provided the advantage of allowing an optimal shape to be achieved in a controlled fashion. Moreover, the inadvertent creation of undesirable retentions or depressions was avoided. After pre-contouring the restoration, finishing and polishing was performed using the Astropol® system (Fig 11).

Conclusion

With state-of-the-art composites such as IPS Empress Direct, natural-looking restorations can be created. Easy-to-use materials in combination with individual layering schemes enable minimally invasive treatment procedures to be employed, even in cases where indirect restorations would normally be indicated. By choosing a suitable restorative and following the treatment protocol described in this article, the three pillars of esthetics can be taken into account in the restoration of anterior teeth (Figs 12 and 13). ❑

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An impressive outcome

Restoring severely discoloured anterior teeth using minimally invasive procedures

Prof Dr Daniel Edelhoff, Munich, and Oliver Brix, DT, Wiesbaden/both Germany

Endodontically treated incisors may entail serious esthetic deficiencies as a result of severe discolouration and present a challenge to the restorative team. The objective of the treatment is to reconstruct the biomechanical and optical properties of the affected teeth, at the expense of as little natural dental tissue as possible. By following a clearly coordinated procedure, the treatment team may achieve satisfactory results with an internal bleaching method, an adhesive post build-up and a preparation technique that suits the requirements of the restorative material. The invasiveness of this approach is considerably reduced as compared with conventional restorative techniques.

This article discusses the rehabilitation of two upper central incisors by placing fibre-reinforced composite posts, using build-up materials and subsequently restoring the teeth with 360° veneers made from lithium disilicate ceramic (LS_2).

Initial situation

A 28-year-old male patient came to the practice and expressed the wish to have his endodontically treated and severely discoloured upper central incisors restored. He said that he had not experienced any problems since the resection of the root some years previously; however, he was dissatisfied with the impaired esthetic appearance caused by the affected teeth (Figs 1 to 3).

***Fig 1** The pronounced discolouration and the inadequate tooth position of the upper central incisors impaired the esthetic appearance.*

***Fig 2** The severe discolouration of tooth 11 also caused a discolouration of the marginal gingival area.*

***Fig 3** The asymmetrical tooth axes of the central incisors are clearly visible.*

***Fig 4** Leaking composite restorations and secondary caries in the endodontically treated teeth 11 and 21*

Fig 5 The root canal fillings were checked prior to the internal bleaching procedure, and the cemento-enamel junction was additionally sealed. The cavities were now ready for the application of the bleaching agent.

Fig 6 Two weeks later: The severe discolourations were almost entirely removed by the internal bleaching treatment.

The clinical and radiological evaluations revealed tight and properly executed root canal obturations in teeth 11 and 21. There were no signs indicating the presence of root canal posts, but the extensive composite restorations in both teeth were leaking and showed secondary caries (Fig 4). At the time of the clinical evaluation, the restorations were already five years old. The specific challenges facing the treatment team was the patient's wish to have the esthetic appearance of his teeth restored in a timely fashion. The patient required that his natural tooth shade and position be restored and, to the extent possible, that the remaining tooth structure be stabilized in the long term.

Treatment planning

Before we proceeded to planning the permanent restoration, the inadequate fillings of the anterior teeth as well as the secondary caries were removed. This allowed us to assess the extent to which the teeth had been damaged. In addition, a possible contamination of the two root canals with microorganisms – resulting from the inadequate fillings which had been in place for years – had to be ruled out.

Both root canal fillings had been tightly sealed at the cemento-enamel junction with separate fillings. The canals therefore did not have to be re-opened. Internal bleaching of the crown portions of both teeth using the walking bleach technique was planned.

After an initial technical and clinical evaluation, the following treatment plan was determined: First, the tooth position and proportions should be corrected by means of an analytic wax-up. The brightness of the affected teeth was then to be adjusted by internal bleaching to match the brightness of the neighbouring teeth during a preliminary treatment phase. Given the extensive lesion, we opted for a direct adhesive build-up after endodontic treatment with cemented fibre-reinforced composite posts. For the final restoration of the severely destroyed anterior teeth, we decided to use 360° veneers based on a lithium disilicate material. In order to achieve an optimum esthetic outcome, the veneers were to be fabricated in the cut-back technique.

Preliminary treatment and preparation

After the coronal pulp chamber of the two incisors had been cleaned, an additional seal was placed at the cemento-enamel junction using a small amount of phosphate cement. This measure ensured that the bleaching agent which would be applied later did not diffuse into these sensitive areas (Fig 5). For the internal bleaching, a mixture of sodium perborate powder and distilled water was applied using the walking bleach method. The palatal access to the coronal pulp chamber was sealed with cotton pellets soaked in bonding agent (Heliobond) and a low-viscosity composite (Tetric EvoFlow®). The next appointment was scheduled one week later. The desired tooth shade had not yet been achieved, and therefore fresh bleaching agent was applied. After another week with the bleaching agent in place, a satisfactory brightness value was observed on both abutment teeth (Fig 6). A calcium hydroxide preparation (CalciPure®) was inserted into the pulp chamber and left in place for a week in order to neutralize the bleaching agent.

After the neutralization phase, we proceeded to the post-endodontic build-up of the abutment teeth. For this purpose, the coronal sealing of the root canal fillings was removed and standardized holes for the fibre-reinforced composite posts (FRC posts) were drilled. The posts were luted with Variolink® II (dual-curing, low viscosity, shade: white-opaque) and a multi-step adhesive (Syntac®). After the posts had been covered with a low-viscosity composite (Tetric EvoFlow), a bright, highly filled viscous composite (Tetric EvoCeram®, Bleach XL) was applied to create the direct build-up (Fig 7). A high-power curing light (bluephase® G2 with > 1,000 mW/cm^2) was used for the final polymerization of the cementation and build-up materials. A diagnostic pattern was employed for the minimally invasive preparation. This template was fabricated on the basis of the wax-up and contained all

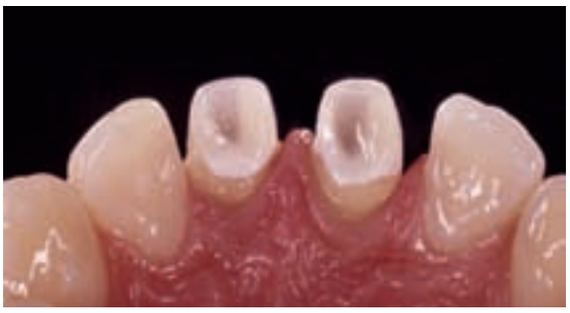

Fig 7 The built-up and prepared incisors. Given the severe degree of destruction, adhesively cemented fibre-reinforced composite posts combined with mouldable composite materials were used.

Fig 8 Lithium disilicate-based 360° veneers made of IPS e.max Press. In order to better mask the dental structure with a minimum layer thickness, an MO ingot was selected.

Fig 9 The optimum masking of the extensively built-up abutment teeth achieved by an MO ingot coping and a try-in paste in the shade white-opaque became evident already during the try-in of the veneers.

Fig 10 Frontal view of the veneers during try-in. The use of lithium disilicate as the basis of the restoration ensured a homogeneous appearance regardless of the substructure.

Fig 11 The 360° veneers were seated with the luting cement that corresponded to the try-in paste used; a multi-step dentin adhesive system was used. Thus, an excellent esthetic outcome could be achieved reliably and predictably.

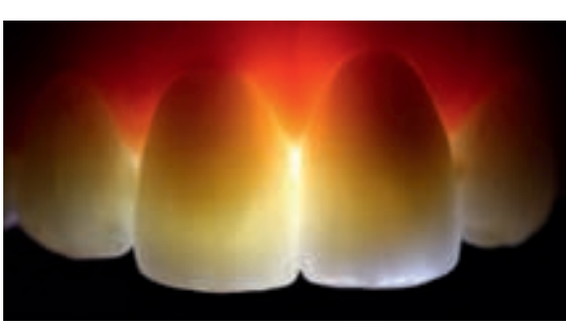

Fig 12 The restorations in transmitted light. By combining translucent build-up materials and glass-ceramic veneers, a light transmission that matches the properties of natural teeth was achieved.

information relating to the correction of the tooth position and the outer contour of the final restoration.

Temporization and fabrication of the final veneers

The diagnostic template was also used for creating the direct veneer temporaries. The temporary restorations could thus be fabricated in a fairly straightforward manner using a Bis-GMA-based temporary material (Telio® C&B, A2). A bonding agent (Heliobond) was applied to the finished, non-etched preparation surfaces and to the inner side of the temporaries and light-cured after removal of excess material.

After a four-week evaluation phase of the tooth shape and position, which both were determined by the wax-up and transferred to the temporaries, a precision impression of the prepared teeth and an impression of the antagonist jaw were taken. This information was sent to the laboratory together with the facebow, the registration of the jaw relation and an image of the prepared abutment teeth. The image showing the preparations helped the laboratory to assess the required degree of opacity for the framework structure. Given the different levels of translucency, the different build-ups of the abutment teeth and to ensure an improved masking capability in case of a relapse of the discolouration, the treatment team chose to use press ceramic ingots with a medium opacity level in shade 0 (MO 0). The IPS e.max® Press frameworks were veneered with the IPS e.max® Ceram veneering ceramic in the shade A2 (Fig 8).

Fig 13 Postoperative view with mandible in protrusion. The final check of the functional and esthetic parameters was satisfactory. The tooth shade excellently matched the adjacent teeth.

Fig 14
Portrait image of the final outcome: The discolourations were removed, the tooth position corrected and the tooth proportions adjusted (for comparison, see Figs 1 and 2).

Try-in and seating

After removal of the temporary restorations, residues of the bonding agent were removed with cleaning brushes and a fluoride-free cleaning paste. In order to check the shape and shade of the veneers in the patient's mouth, the restorations were tried in with a shaded glycerine gel (Try-in Paste, Variolink II, white-opaque). A perfect masking of the abutment teeth was already achieved at this stage and the resulting situation showed a harmonious appearance regardless of the substructure (Figs 9 and 10).

The inner aspects of the glass-ceramic veneers were etched with a hydrofluoric acid gel (< 5% IPS® Ceramic Etching Gel) for 20 seconds. Subsequently, a bonding agent (Monobond Plus) was applied. Only the multi-step dentin adhesive system Syntac was applied to the tooth. The restorations were luted into place with the Variolink II system (white-opaque) (Fig 11).

Conclusion

A light transmission which corresponds to that displayed by natural teeth was achieved by using translucent build-up materials in conjunction with glass-ceramic lithium disilicate veneers (Fig 12). The final outcome with regard to functional and esthetic parameters was found to be very satisfactory at the final evaluation. The tooth shade was in perfect harmony with the surrounding dentition. In addition to removing the severe discolouration of the hard and soft tissues, we were able to correct the tooth position and adjust the tooth proportions (Fig 13). The patient was fully satisfied with the esthetically pleasing outcome and did not experience any phonetic problems resulting from the correction of the tooth position (Fig 14). ❑

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Ultra-thin, but highly effective

Minimally invasive treatment with non-prep ceramic veneers

Dr Alejandro James Martí, Dr Rosa Antonia López Parada and Francisca Hernández, DT, León/Mexico

As a result of the wide selection of dental restoratives available today, clinicians are able to use restorative procedures involving minimal or no preparation, which take both functional and esthetic aspects into account. Due to the reliable bonding effect achievable with state-of-the-art adhesives, heavily invasive preparation schemes are being increasingly avoided. One of the major goals in modern dentistry is to maintain as much of the natural tooth structure as possible. In some cases, we can even do without any preparation of the tooth, as will be illustrated by means of the clinical case shown below.

Case report

A male patient presented to our office, whose tooth 21 had a chip on the distal portion of the incisal edge. The clinical examination revealed several worn areas which were due to occlusal disharmony (Fig 1). The mandibular position was restabilized in line with the centric occlusion of the teeth in order to prevent further damage due to functional disorder. We decided to restore tooth 21 with a non-prep veneer. The state-of-the-art materials available today gave us the option of using this procedure which involved minimal invasiveness. After taking an impression with Virtual® addition silicone material, a photographic record was made and the tooth shade was determined. Subsequently, the data were sent to the dental laboratory.

Dental laboratory procedure

A working model was fabricated using the Geller technique, which served as the working basis. In other words, tooth 21 was designed as a removable die (Fig 2). The die was duplicated using Double Take duplicating material and then reproduced in refractory die material. Based on a layering scheme set up beforehand, the veneer was built up with IPS d.SIGN® fluorapatite glass-ceramic (Figs 3 to 7).

Clinical procedure conducted in the dental practice

Using Variolink® Veneer Try-In pastes, the veneer was tried in the mouth. Try-in pastes allow the right shade of the luting material to be determined and thus ensure an optimum esthetic result. We recommend using positioning aids such as OptraStick®, as they make handling of the laminate veneer a lot easier (Fig 8). After having checked the fit of the restoration, the try-in paste was rinsed off with water and the laminate veneer placed in an alcohol solution in an ultrasonic cleaner to remove all the contaminants. Then the veneer was thoroughly rinsed again with water. Subsequently, the inner surfaces were etched with 5-per cent hydrofluoric acid (IPS® Ceramic Etching Gel) for 60 seconds (Fig 9). By

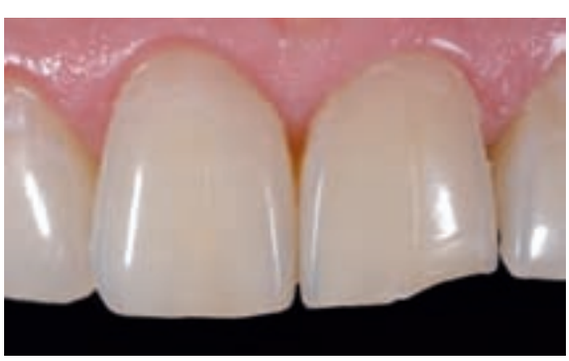


Fig 1 Chipped distal incisal edge of tooth 21

Fig 2 Plaster cast according to Geller with removable die

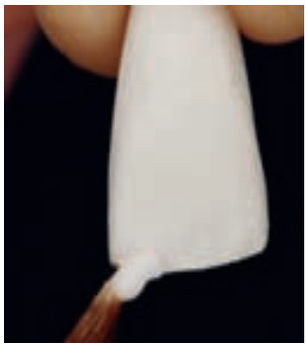
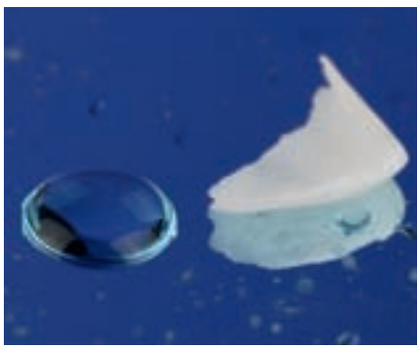


Fig 3 Layering of the laminate veneer on the refractory die

Figs 4 and 5 Repositioning of the ultra-thin veneer on the model



Figs 6 and 7 The laminate veneer is translucent and as thin as a contact lens.

Fig 8 To achieve an esthetic outcome, the shade of the luting composite needs to be determined. Placement instruments simplify the handling of the veneer.

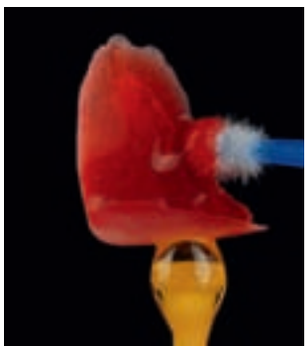


Fig 9 Etching of the restoration for 60 seconds

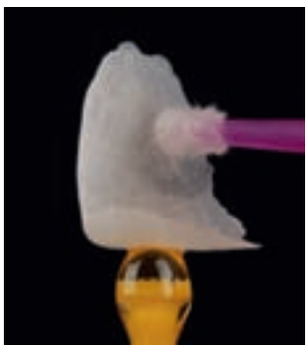


Fig 10 Silane is applied.

Fig 11 Prior to etching the enamel with Total Etch, the adjacent dentition was protected with Teflon tape.

means of this etching procedure mechanical retentions were created. After having removed the hydrofluoric acid with water, the laminate veneer was cleaned in an alcoholic bath in the ultrasonic unit and rinsed again with copious amounts of water. Then the veneer was dried. We applied Monobond Plus to the inner surfaces and left it to react for 60 seconds (Fig 10).

When laminate veneers are adhesively cemented, it is essential to establish a completely dry treatment field. Normally, the placement of a rubber dam is recommended (eg OptraDam®) to avoid any kind of contamination. As a next step, the enamel was etched with Total Etch (37-per cent phosphoric acid gel) for 15 to 30 seconds. We recommend protecting the adjacent teeth with Teflon tape during this procedure (Fig 11), as this will prevent the teeth from being etched inadvertently. Moreover, excess gel is easier to remove. The enamel surface was rinsed with water for 5 seconds to remove the etching gel and subsequently air-dried for another 5 seconds. Next, a coat of adhesive was applied. In the case presented, we used ExciTE® adhesive.

Then Variolink Veneer luting composite was applied to the inner surfaces of the veneer directly from the syringe with the application tip. We positioned the veneer on the tooth (Figs 12 and 13) and applied slight pressure in a vertical direction to squeeze out any excess material. Subsequently, the inserted restoration was light-cured from the vestibular and palatal aspects for 10 seconds each. Removal of excess material was accomplished with scalpel no. 12 (Fig 14). To prevent an oxygen-inhibited layer from forming on the composite surface, the margins were covered with glycerine gel (Liquid Strip) and light-cured again from both aspects for 30 seconds (Fig 15). Finishing and polishing of the

Fig 12 Application of the luting composite to the inner surfaces of the veneer

Fig 13 OptraStick was used to position the veneer on the tooth.

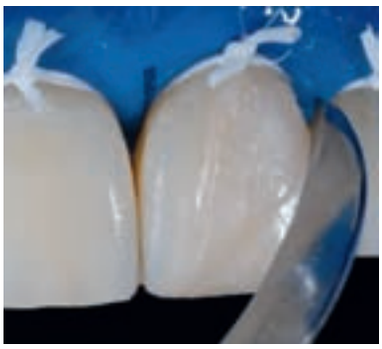


Fig 14 Following light-curing, excess cement was removed.

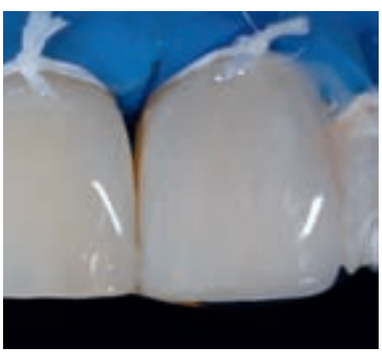
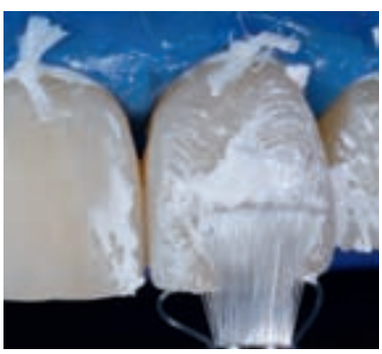


Fig 15 The cement joint was coated with glycerine gel and then light-cured.



Figs 16 and 17 Finishing and polishing of the margins

restoration was performed with the Astropol®/Astrobrush® system (Figs 16 and 17).

Conclusion

In the case presented, we were able to reconstruct the chipped distal portion of the incisal edge of tooth 21 without prior tooth preparation (Fig 18). Modern treatment concepts and the dental materials available today allowed us to successfully apply this type of procedure, which helped to preserve as much natural tooth structure as possible. It is definitely a valuable addition to our range of treatment options, particularly when it comes to restoring worn down or chipped teeth. However, prior to performing such a procedure, the cause of the chipping should be established as functional therapy may be required. ❑

Fig 18 The restoration in situ: We succeeded in perfectly mimicking the shape and shade of the natural tooth and concealing the transition between the ceramic and the natural tooth structure.

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Just an everyday story

Restoring extensive coronal lesions with IPS e.max®

Florin Stoboran, DT, Oradea/Romania

Lab-fabricated ceramic inlays, onlays or table tops are an alternative to the direct restoration of posterior teeth with composite resin. These restorations fabricated by the dental technician offer some advantages, such as the possibility to design a detailed morphology and to create a lifelike shade design. This article discusses the fascinating possibilities offered by IPS e.max® Press and IPS e.max® Ceram in the fabrication of all-ceramic inlays.

Around seven years ago, I discovered a special all-ceramic system: IPS Empress® 2 and the layering ceramic IPS Eris® from Ivoclar Vivadent. The company advertised the highly esthetic results that could be achieved with this system, particularly with regard to the shade design in single crowns as well as inlays and onlays. I was eager to find out for myself and so I tried the system. The material fulfilled my expectations, but I found one aspect to be unsatisfactory: The material's strength was still not optimal for the fabrication of inlays and onlays. Great care had to be taken while sandblasting the restoration margins in order to prevent the thin margins from breaking. The entire processing therefore became rather time-consuming. However, this did not keep me from continuing to work with the material, because the esthetics of the results made all efforts worthwhile.

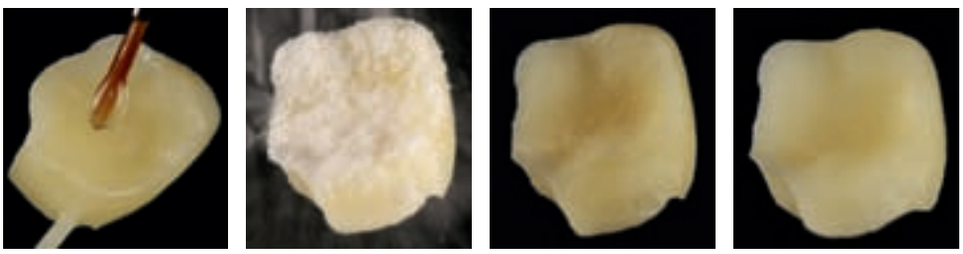
Today, the IPS e.max Press lithium disilicate (LS_2) glass-ceramic ingots afford dental technicians a range of materials which allows them to meet all requirements in terms of mechanical properties and esthetics. Chipping, as it tended to occur under time pressure, is a thing of the past, thanks to the outstanding strength of 400 MPa. The IPS e.max Press range comprises five ingot types with different translucencies. Of these, I use the LT, HT and Impulse ingots for inlays and onlays (LT = low translucency, HT = high translucency).

Shade determination

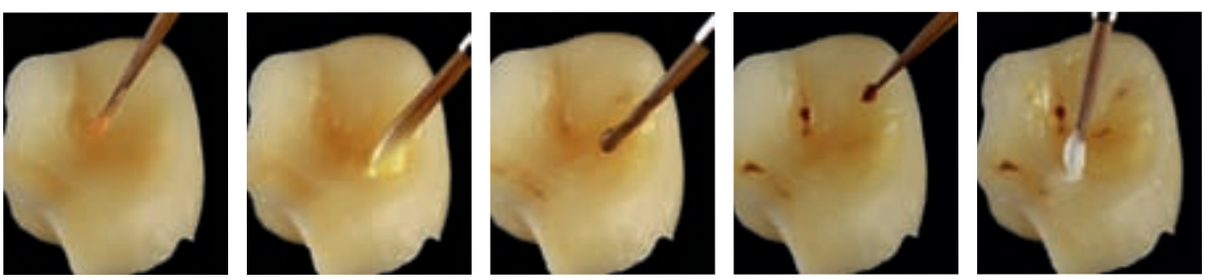
Shade determination is a crucial step in the fabrication of ceramic restorations. I use the canine as a reference, as this tooth shows a very high dentin portion. In the present clinical case, an LT ingot in the shade B3 was selected due to the size and depth of the lesion (Figs 1 and 2). The shade of the cervical area of the tooth was B3, and a somewhat brighter shade was selected for the cusps (B2). I wanted the restoration to show a shade saturation from the inside. Given the depth of the defect, an LT ingot with lower translucency and a lifelike bright-

Fig 1 Initial situation: extensive and deep lesion after endodontic treatment

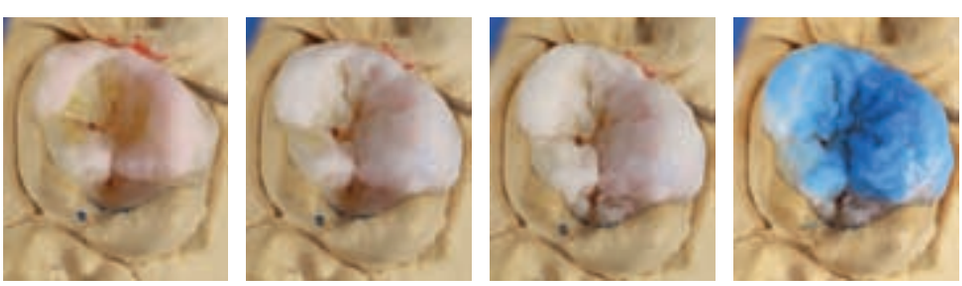
Fig 2 The canine was used for shade determination. The antagonist served for comparison.



Figs 3a to d For the wash firing, the framework was wetted with glaze liquid and sprinkled with Dentin powder (B3).



Figs 4a to e Characterization with stains and shades



Figs 5a to d Anatomical layering with various ceramic materials

Fig 6 The result after the final firing cycle and polishing

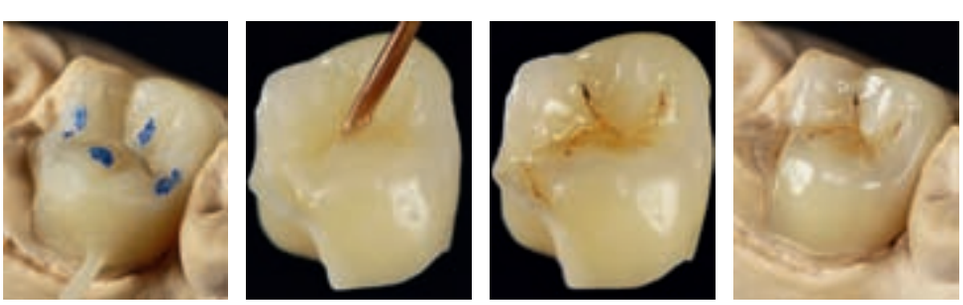


Fig 7 The fully anatomically pressed restoration is ready for the staining technique.

Figs 8a and b Characterization with stains and glaze material

Fig 9 Result after the glaze firing and polishing

ness value and chroma was selected instead of an HT ingot. An inlay of this size might have shown a greyish shade effect if an HT ingot had been used. After the shade group had been determined on the basis of the canine, all subsequent work steps were completed within this shade group. In this case, B was determined as the shade group. To illustrate this: The canine in this case had the shade B3; consequently, all the work was devised so as to lighten up or darken this shade according to the specific requirements.

To document this patient case, two different approaches were pursued: On the one hand, a cut-back IPS e.max Press framework was layered with IPS e.max Ceram, and on the other hand, a fully anatomical inlay was pressed and characterized during the glaze firing.

The layering technique

First, residues of the investment material were removed from the framework with aluminium oxide (110 µm, 2 bar/29 psi). Subsequently, the surface of the framework was sandblasted with glass polishing beads. Given the excellent strength of the lithium disilicate material, the risk that the restoration would break at the margins was eliminated. After sandblasting, glaze liquid was applied in a thin layer and Dentin powder in the same

Fig 10 Try-in of the fully anatomically pressed and stained inlay

Fig 11 Try-in of the ceramic-layered inlay

Fig 12 The inlay in place

shade as the ingot was sprinkled onto the framework. This step improves the bond between the layering ceramic and the lithium disilicate material and furthermore creates a "diamond effect" under incident light (Figs 3a to d). After the initial firing cycle at 750°C (1382°F), a stains firing was conducted, in the course of which fine, more detailed characterizations were designed. For this purpose, highlights were created with stains materials: Darker colours were used in the deeper areas of the restorations (central fossa) and lighter colours in the elevated areas (cusp tips) (Figs 4a to e).

The layering diagram applied after stains firing was fairly straightforward: Dentin (B2) for the cusps, some Opal Effect 2 (OE2) between the cusps towards the central fossa (depth effect) and some Transpa Incisal (TI1) to imitate the anatomy of the posterior tooth; this layer, however, was restricted to 0.2 mm below the final restoration outline in order to leave some room for OE4 material. This material is capable of reflecting light to some extent, which is why it is often used to imitate the whitish effect seen on the cusp tips (Figs 5a to d). After layering and another firing cycle at 750°C (1382°F), I focussed on the design of the surface textures, which I created with rotary grinding instruments and sealed by means of a glaze firing conducted at 715°C (1319°F). Subsequently, the restoration was polished with rubber polishers and a diamond paste (Fig 6).

The staining technique

All morphological properties of this molar, including the surface texture, were already designed in the wax-up. After the ceramic inlay had been pressed and divested, the surface was slightly ground and the contact points as well as the occlusion were checked (Fig 7).

The same stains as the ones used in the layering technique were applied and subsequently fired in a stains and characterization firing (Figs 8a and b). Care should be taken not to apply the stains too excessively in order to prevent a "mirror" effect; if the material is applied too thickly, the light is reflected from the restoration surface and does not penetrate it. As a result, the desired translucency is not achieved. The shape and the marginal adaptation were checked with silver powder before and after the glaze firing. Finally, the restoration was polished to a high gloss with a rubber polisher and diamond paste (Fig 9).

Comparison

Both restorations were tried in intraorally, and both showed a nearly perfect marginal fit. Therefore, the restoration which was actually to be cemented into place had to be selected on the basis of esthetic considerations. The monolithic structure and the fact that only pressed lithium disilicate, the strongest pressable ceramic tested to date, was used would have been a reason to use the stained restoration (Fig 10). From the point of view of mechanical and functional properties, this restoration would have been preferred; however, it did not show the desired translucency. If the two restorations were compared, the layered restorations clearly showed a superior shade effect (Fig 11), and thus this restorations was permanently seated (Fig 12).

Conclusion

IPS e.max Press and Ceram in conjunction with an adhesive cementation protocol represent a valuable asset for dental technicians. For instance, the system allows you to fabricate highly esthetic inlays with an excellent strength. It is thus a highly attractive alternative to direct inlay restorations, offering advantages to patients, clinicians and dental technicians alike. ❑

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New ways have to be taken sometimes

Veneer restorations layered onto pressed ceramic substrates

Szabolcs Hant, MDT, Budapest/Hungary

In the case below the author describes two methods of creating an anterior restoration: a conventional method where the veneers are layered and fired on an investment die and an unconventional method involving layered veneers on a pressed ceramic substrate.

Initial situation

Teeth 11 and 21 should be esthetically corrected in this discerning male patient. He was particularly concerned about the palatal position of the teeth and the discoloured composite restorations (Fig 1). The aim was to find a treatment option that would involve as little loss of healthy tooth structure as possible in line with the principles of conservative dentistry.

An analytical evaluation of the diagnostic model showed that a minimally invasive esthetic modification could only be achieved with ceramic veneers (Fig 2). At this stage, we were still considering the possibility of using a totally non-invasive treatment option. The palatal position of the upper two central incisors afforded enough space to accommodate a layered non-prep veneer. Already at this stage we decided to use two different methods and compare them with each other: one of them conventional and the other one still relatively unknown in our market.

Fig 1 Initial situation: The patient is unhappy about the discoloured composite restorations and the uneven alignment of the teeth.

Fig 2 A model of the initial situation shows the palatal deviation of the central incisors.

Conventional method

For the conventional method we opted for a metal-ceramic system (IPS d.SIGN®), which involves firing of the veneers in an investment ring. The veneers were modelled on investment dies (GC Orbit Vest) that had been prepared beforehand (Figs 3 to 6). When applying the layers, I masked the areas of the composite restoration with Deep Dentin to prevent it from shining through the ceramic layers. I generally use a translucent material for the cervical region, unless the underlying tooth structure is completely discoloured. For the present case, I applied Transpa Neutral and Opal Effect 1 materials. The advantageous translucent properties of Transpa Neutral and the incisor-like opalescence of Opal Effect 1 provide a suitable combination for this region. In my experience, this technique has proved to be successful, allowing the transition in the cervical region to be effectively camouflaged.

It is essential to work in small steps when working with an investment die. The mechanical and chemical bond between the investment material and ceramic material is not as strong as the bond between the opaquer and ceramic material when a conventional layering technique

Fig 3 Deep Dentin is applied in layers to achieve an appropriate masking effect.

Fig 4 Transpa and Opal materials complete the layering procedure.

Fig 5 Veneers layered on investment dies

Fig 6 Veneers after divesting

Fig 7 When the veneers were tried in …

Fig 8 … neither the patient nor the treatment team were satisfied with the outcome.

Fig 9 The incisal was too bright and the veneers appeared slightly oversized.

on a framework is used. It is imperative to bear this in mind since it is very difficult to mend the restoration if ceramic material has detached itself from the investment die because it was applied in too thick a layer. For the present case, a comparatively thin layer of dentin material was sufficient because this restoration did not involve a metal framework masked with opaquer. Consequently, more space was available for the enamel materials.

Upon completion of the firing process, the investment dies were removed and the veneers were tried in. An optimal result was achieved in the cervical region. The use of a matching try-in paste (Variolink® Veneer Try-In) was helpful in this respect. The shade of the incisal area also appeared to be successful; the tooth's inherent shade was shining through the translucent layers of the incisal area. However, things often turn out to be different than expected: Upon close examination, we spotted the shortcoming that was unacceptable to our esthetically discerning patient: The incisal was slightly brighter than that of the neighbouring teeth, as can be seen in pictures 7 to 9. In addition, the veneers

Fig 10 The pressed veneers were ground down to a thin material thickness and were used as a substrate for the subsequent application of ceramic layers.

Fig 11 Try-in of the pressed veneers before the layering procedure

Fig 12 Evaluation of the shade effect after the first firing

Fig 13 The veneers layered onto a substrate made of IPS e.max press ceramic

were oversized and failed to integrate harmoniously into the surrounding dentition.

An innovative method

I had to find a treatment option which would enable me to provide the patient with a satisfactory result. In response to this situation, I opted for a technique that was based on a similar approach as the one above but involved different materials: The range of IPS e.max® press ceramics includes highly translucent HT ingots. Strictly speaking, these materials were developed for full-contour inlays, onlays, veneers and crowns. Given their high viscosity and high flexural strength (400 MPa), they are, however, also suited for ultra thin (0.3 mm) veneers.

For the present case, the veneers were pressed from HT A2 ingots and then ground down to a thickness of 0.3 mm (Fig 10). A try-in on the patient showed that this material was capable of closely imitating the natural tooth shade (Fig 11).

When I applied the layering ceramic, I again had to take the existing composite restorations into account. I used the try-in pastes to simulate the shade effect and to check if the composite restorations were sufficiently camouflaged. Enough space was available to design the incisal, which meant that I was able to control the translucency in this area appropriately. To mask the discoloured areas in the proximal regions of the restorations, I used opaque materials. The IPS e.max® range offers two choices to achieve this: Deep Dentin and Mamelon materials – both of them are characterized by comparatively strong masking capabilities. However, the Mamelon materials should be used only sparingly for application in this area. Except for the "light" shade, these materials demonstrate fairly distinct shading characteristics and may therefore have a visible effect on the restoration. Subsequently, the Dentin and Transpa materials were applied in layers in the customary manner. The restoration in progress could be directly checked in the oral cavity between the individual firing cycles and the materials could be selected accordingly, which presented a decisive advantage (Fig 12).

As aforementioned, the veneers which I designed first were not satisfactory because of their shape. I therefore created a slightly narrower incisal this time and, consequently, was satisfied with the result (Fig 13). The patient also approved of the shape and I therefore proceeded to incorporate the veneers (Fig 14).

Incorporation

The use of two different ceramic materials provides a convenient opportunity to point out the differences in etching techniques. Etching the ceramic veneers with

Fig 14 The veneers in situ. Both the patient and treatment team are satisfied with the outcome. Sometimes it takes more than one attempt …

hydrofluoric acid (IPS® Ceramic Etching Gel) presents an essential and critical stage of the adhesive technique. The etching time depends on the ceramic material. In the present case, the reaction times for the individual ceramic materials were different from one another. The manufacturer recommends an etching time of 60 seconds for the IPS d.SIGN fluorapatite ceramic, whilst the recommended etching time for the IPS e.max Press lithium disilicate ceramic is 20 seconds. Users should not deviate from these recommendations.

After the etchant has been allowed to react, the surfaces should be thoroughly rinsed with water. I usually use an ultrasonic device to optimally clean the surfaces. Whilst etching of the veneer can be deferred to the dental technician, it is absolutely essential to be aware of the fact that the surfaces that are already etched have to be cleaned again after the try-in in the oral cavity, before the veneer is silanized (Monobond Plus). Study results have shown that contaminations from salivary fluids remain on the surface and adversely affect the bond strength, particularly if glycerine-based try-in pastes are used.

Conclusion

Veneers made of IPS d.SIGN ceramic materials have been used to design restorations that provide exceptional esthetic results for several years. However, today's range of products includes various other materials and methods that enable you to achieve equally pleasing or even better results in certain cases. The IPS e.max system is a case in point. It is worthwhile considering new routes of fabricating a restoration, depending on the requirements of the individual patient case, and allowing some scope for creativity. In the process, however, the specific properties and possible restrictions of the material used should never be ignored. ❑

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