REFLECT

1/14

Esthetics in daily routine
Introducing the Posterior Anatomical Technique

The art of mimicking nature
Minimally invasive treatment of stained anterior teeth using veneers

Simply more choice
Monolithic anterior IPS e.max CAD crowns

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In 2014, Ivoclar Vivadent will continue to introduce new and innovative solutions to the market and thus pursue its course of success. The expectations of our customers are as high as ever. In order to meet their requirements, we are not only focusing on the development of new products and technologies but we are also expanding our global sales network. Because one thing we know for sure: If you want to offer your customers high-quality support and services, you need to be on site and know the market well.

Last year, we celebrated the inauguration of our new subsidiary in Moscow. Additionally, we opened a new education and training centre. These new facilities form the foundation which will allow us to respond to the demands of our Russian customers at an advanced professional level. We are proud of this achievement.

The present issue of Reflect contains a diverse range of interesting topics. Read about the many possibilities of the sculptable Tetric EvoCeram Bulk Fill composite, which allows you to place posterior restorations even more efficiently. We invite you to discover its wide range of applications. Furthermore, this issue includes new articles regarding the highly esthetic IPS Empress Direct composite and IPS e.max.

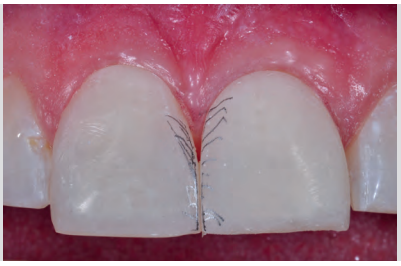
I hope you will enjoy reading this issue of Reflect and I wish you every success in your daily work.

Best wishes

Stephan Uhlmann
Managing Director
Ivoclar Vivadent Russia

CONTENTS

Page 5



Page 10

Page 14

Take advantage of the versatile options offered by digital magazines for tablets and experience the iPad edition of the article: "The art of mimicking nature" by Dr Stefen Koubi and Gérald Ubassy (pp. 12-15). Benefit from the interactive photo sequences with additional pictures, and learn more about the products used and the authors.

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Esthetics in daily routine

Posterior Anatomical Technique (PAT) – an efficient approach towards esthetic posterior restorations
Dr Rafael Piñeiro Sande, Vigo – Pontevedra/Spain

Life-like restorations and efficient workflows are core factors in the day-to-day routine of dental professionals. This article describes a new filling technique which meets these basic demands.

Esthetics play undoubtedly a most critical role in modern society. Today's image of society and people is primarily based on esthetic appearance which in turn has an impact on how we perceive a person's health status [1]. This social trend has also reached and influenced the world of dentistry, with patients demanding fast and highly esthetic restorations [2,3]. The Posterior Anatomical Technique (PAT) for posterior restorations meets all of these demands. If applied in combination with bulk-fill composites, this technique results in shorter treatment times and reliable esthetic outcomes. Furthermore, the durability and applicability of these composite materials have already been proven to exceed those of amalgam fillings [4,5], which are no longer acceptable for many patients.

The Posterior Anatomical Technique (PAT)

Today's excellent dental health care and prophylaxis measures mean that the majority of carious lesions are identified in their early stages when the occlusal anatomy of the tooth is still preserved [6,7]. Unfortunately, the situation is often different in the case of carious lesions in the posterior region. Here, the dental anatomy is frequently already lost when the patient attends the clinic [8]. The Posterior Anatomical Technique differentiates between two categories, depending on the degree of the carious destruction:

1. no loss of anatomical tooth shape (direct restoration of the anatomy)
2. loss of anatomical tooth shape (indirect restoration of the anatomy).

The clinical approach of PAT is the same for both categories and commences with duplicating the anatomical tooth shape using a transparent silicone key. Subsequently, all carious lesions are removed and the cavity is prepared and conditioned. Finally, the information from the silicone key is transferred to the permanent restoration. In case of a non-conserved anatomy, a silicone impression of the initial situation is taken and transferred to a stone model. The missing anatomy is then reconstructed with wax on the stone model. Subsequently, this wax-up is duplicated using transparent silicone to create the envisaged "clinical" situation.

Fig. 1
Starting situation with occlusal carious lesions on teeth 36 and 37

Bulk-fill materials

Bulk-fill composites can be readily incorporated into the PAT workflow described above. For example, Tetric EvoCeram® Bulk Fill allows for a correct use of the PAT as well as good esthetic results due to its optimum material properties. The consistency of this material at a temperature of 37 °C is ideal to rebuild the anatomical shape using a silicone key. Furthermore, its translucency level of 15 per cent enables the material to achieve a highly esthetic integration in all Class I and Class II lesions. The polymerization of layers of up to 4 mm does not adversely affect the material properties as this composite contains a highly reactive light

Fig. 2 Duplicating the occlusal surfaces using transparent silicone material

Fig. 3 Defining the cavity depth

Fig. 4 The Cavifil delivery form ensures a homogeneous application.

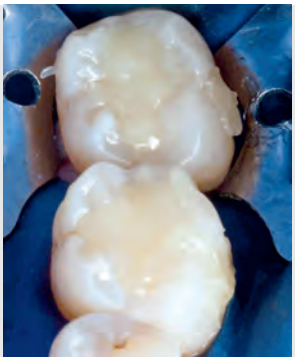

Fig. 5 The material fills the entire cavities.

initiator (the Ivocerin® polymerization booster) and a shrinkage stress reliever in addition to the conventional light initiators. The material's excellent polishing properties are enhanced by fine filler particles which ensure a reliable surface stability and long-lasting esthetics. Additionally, its Vickers hardness of 620 MPa and a hardness value of more than 80 per cent for increments of up to 4 mm define Tetric EvoCeram Bulk Fill as a reliable posterior composite. In general, the curing requirements are met if 80 per cent of the maximum surface hardness are achieved at an increment depth of 4 mm [9]. The possibility to use characterization materials represents an additional asset.

Clinical cases

Case 1

The starting situation shows Class I lesions with the anatomical shape preserved (Fig. 1). Initially, a rubber dam (OptraDam® Plus) is placed to isolate the treatment area [10]. Subsequently, the teeth to be restored are cleaned using a brush and fluoride-free Prophy paste (Proxyt® RDA 36) and enfolded with transparent silicone. Transparent minicuvettes can be used to ensure a precise impression (Fig. 2). Once the silicone has set, the "impression" is checked for air bubbles, especially in the occlusal regions (fissures).

After the caries has been removed, the depth of the preparation is measured (Fig. 3). Cavities of up to 4 mm can be restored with a single layer of Tetric EvoCeram Bulk Fill. Its Cavifil delivery form is optimally suited to apply the material in a homogeneous layer as it facilitates adapting the composite material to the cavity walls (Fig. 4). The cavity must be filled completely with the material (Fig. 5), which is subsequently formed using a suitable modelling instrument (OptraSculpt® with ball tip) and pressed to the cavity walls. Since the composite has been preheated to 37 °C prior to use, it can ideally adapt to the silicone key which is placed onto it using slight pressure [11] (Fig. 6).

Then, the silicone key is removed and the restoration is covered with glycerine gel (Liquid Strip) in order to prevent the formation of an oxygen-inhibited layer. Subsequently, the material is light-cured for at least ten seconds using a light intensity of 1,000 mW/cm² (Bluephase® 20i, High Power program). Due to the differences in the translucency of composite materials, the light-curing units play an essential role in the restoration process [12]. Their performance and wavelength range are crucial factors. Once the composite has completely cured, the excess material is removed and the restoration is polished using a silicon carbide polisher (Astrobrush®) (Figs 7 and 8).

Fig. 6 The silicone key is placed on the restorations exerting light pressure. Excess composite material can drain off, preventing an "overflowing".

Fig. 7 Polishing with a silicon carbide instrument (Astrobrush)

Fig. 8
The completed restorations show an excellent esthetic integration into the oral environment.

Fig. 9 Starting situation with carious lesions on the distal surface of tooth 14 and on the mesial surface of tooth 15

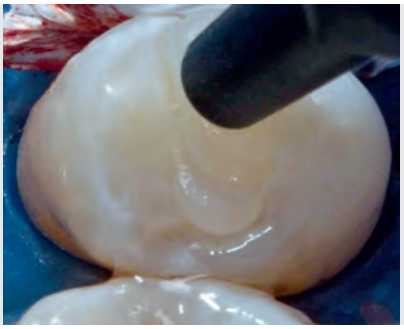

Fig. 10 Tetric EvoCeram Bulk Fill is optimally suitable for PAT due to its consistency, adaptability and clinical behaviour at 37 °C temperature.

Fig. 11 The characterization with IPS Empress Direct Color provides an added esthetic bonus to the restoration.

Case 2

Carious lesions in posterior regions often involve the proximal areas, requiring Class II cavity restorations. In general, the same working steps as described in Case 1 have to be performed. The only difference consists in an interim step to transform the Class II cavity into a pseudo Class I cavity.

An important aspect to be highlighted in the presentation of this patient case is the clinical behaviour of the composite material used (Fig. 9). The adaptability and translucency of this material as well as the possibility of using characterization materials (IPS Empress® Direct Color) allow the dentist to imitate the adjacent structures as naturally as possible (Figs 10 and 11). After completion of the mesial filling, the distal restoration is placed in the neighbouring tooth (Fig. 12).

A sectional matrix assists in obtaining precise proximal contact points.

If this procedure is performed accurately, the following occlusal check will require only minor adaptations if any at all (Figs 13 and 14).

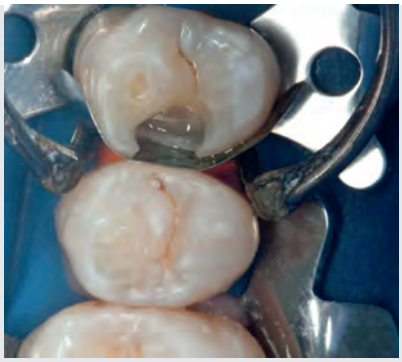

Fig. 12 Removal of the carious lesions from tooth 14 after completion of the restoration on tooth 15

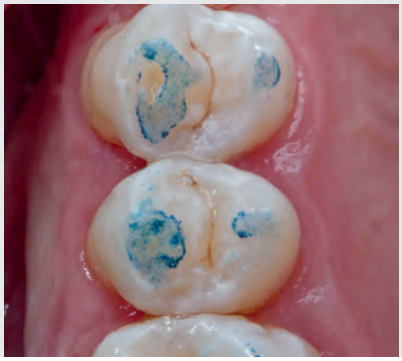

Fig. 13 This technique requires no or only minimal occlusal adaptations.

Fig. 14 The completed restorations. The characterizations enhance the esthetic integration.

Fig. 15 Opening of the access area and removal of the carious lesions after endodontic treatment

Figs 16a to d
Indirect restoration of the tooth anatomy on a stone model; replication of the anatomy using a transparent silicone key

Fig. 17
Reconstruction of the deeper areas with MultiCore Flow

Fig. 18
Result after the occlusal check: The restoration integrates well into the oral environment.

Case 3

This third and final case presentation reports the restoration of a molar tooth which was subjected to endodontic treatment and demonstrated extensive carious lesions with a significant loss of the tooth anatomy (Fig. 15). In the first treatment step, a silicone impression (Virtual® 380) is taken and copied in a stone model in order to reconstruct the tooth anatomy. Subsequently, a transparent silicone impression is made of this stone model which allows the tooth to be treated as if it had "only" a carious lesion without any loss of tooth anatomy (Figs 16a to d) (similar to the case described above).

The restoration process starts by applying a flowable core build-up composite (MultiCore® Flow), which seems to be particularly suitable for these kinds of restorations [12] (Fig. 17). The filling is then finalized using a layer of Tetric EvoCeram Bulk Fill and characterized with IPS Empress Direct to enhance the esthetic integration of the restoration (Fig. 18).

Summary

Esthetics, functionality and shorter treatment times represent key requirements of modern dentistry. The Posterior Anatomical Technique meets all of these demands. PAT can frequently be used in common clinical situations, leads to reliable results and its success is only marginally dependent on the expertise of the dental professional. Bulk-fill composites are optimally suited for this technique, with Tetric EvoCeram Bulk Fill being perhaps the most suitable material due to its physical and optical properties as well as its ease of processing. This material is a solution for almost any kind of posterior restorations.

A literature list is available from the editors on request.

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Why not choose a composite?

Diastema closure and minimally invasive reconstruction of functionally abraded anterior teeth

Dr Martin von Sontagh, Hard/Austria

Modern composites can be employed for many different applications. They are an ideal material to restore the function and esthetics of the dentition in patients with diastemata or heavily abraded teeth.

Increasing numbers of patients seek dental advice because their teeth have lost tooth structure due to functional wear. It is not rare that people process their stress in the daytime by grinding their teeth at night and so bruxism has become a frequent diagnosis. What treatment options are available for patients with dental wear and tooth structure defects? The primary objective is to prevent the further loss of hard tissue. In this context, modern composites may be the material of choice. They enable a minimally invasive treatment procedure – even patients suffering from functional dental problems can be treated using a gentle, conservative method.

Preoperative situation

A young patient visited the practice with the wish to have the gaps between his anterior teeth closed and the tooth defects corrected (Fig. 1). An orthodontic examination was performed and an esthetic wax-up created. In the end, however, the patient decided to go through the treatment without orthodontic therapy.

After having studied the photographs and model, I developed a treatment plan tailored to the specific needs of the patient (Fig. 2). It was necessary to re-establish the width and length proportions of the teeth. In addition, the longitudinal axis of teeth 14 to 24 needed to be realigned with the help of composite veneers (Fig. 3).

Clinical procedure

First, the teeth were gently prepared for realignment with the veneers (Fig. 4). To create a dry treatment field, I used an OptraGate® lip-cheek retractor. An additional advantage is that this auxiliary makes it easy for patients to keep their mouth open.

Fig. 1
Preoperative view: The patient wanted the diastemata in the upper jaw to be closed without undergoing orthodontic treatment. The anterior incisal edges showed abrasive wear.

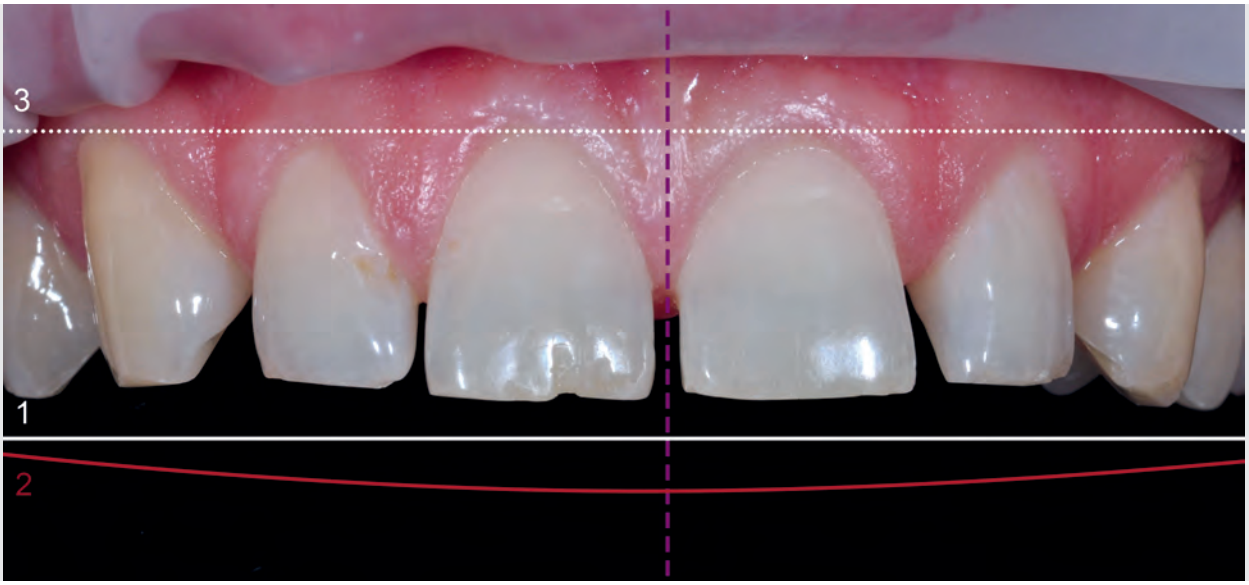


Fig. 2 The photographic analysis clearly showed a lack of correspondence with the natural smile line (2). The incisal edges of the anterior teeth were located on a flat plane.

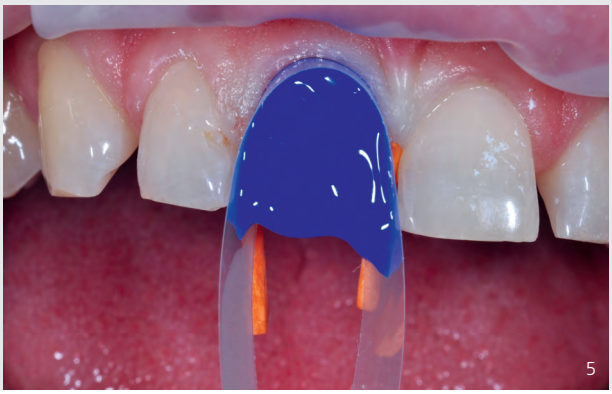
A matrix band was placed to achieve tight contact points, whilst at the same time avoiding overcontouring. Following the usual procedure, the tooth structure was etched, allowing the phosphoric acid to react with the enamel for 30 seconds and then ExciTE® F adhesive was dispensed from the VivaPen brush cannula and brushed into the tooth structure for ten seconds (Figs 5 and 6).

Fig. 3 The view from the cranial showed that the longitudinal tooth axes were not straight and the incisal edges did not match the curve of the lips. In the course of the treatment planning process, the patient expressed the wish to have his teeth straightened. As a result, the longitudinal tooth axes were realigned.

Fig. 4
Subtle veneer preparation was performed to ensure that the realigned teeth would be on the same axis.

Fig. 5
A matrix band was placed and the tooth etched with phosphoric acid for 30 seconds.

Fig. 6
Application of ExciTE F



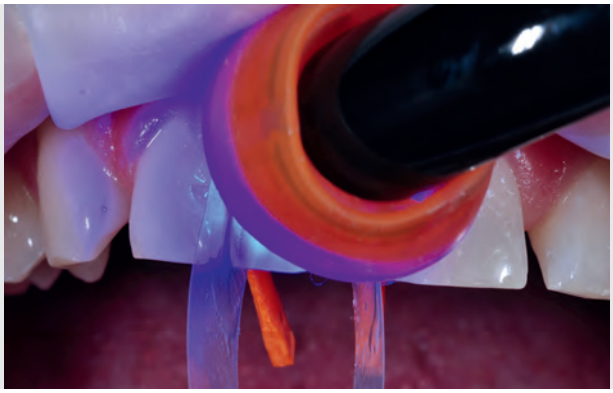


Fig. 7 Precuring for ten seconds with Bluephase Style

Fig. 8 A slightly darker shade was used for the tooth neck to give it a more natural appearance. IPS Empress Direct Dentin A3 was employed for this purpose.

Fig. 9 A smooth surface can be quickly achieved using an OptraSculpt Pad.

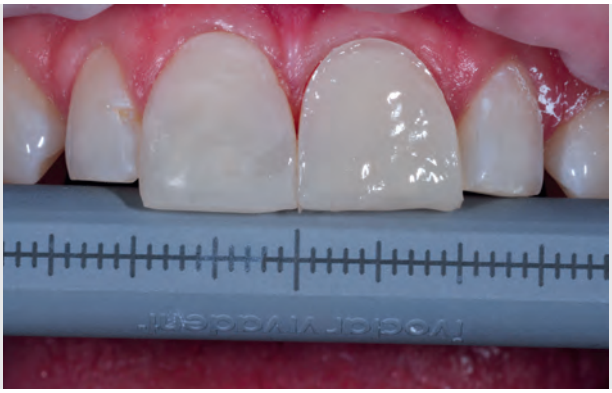


Fig. 10 The reference scale on the handle of the Optra Sculpt Pad was used to check the tooth width and evaluate the longitudinal axis.

After dispersing the solvent, I light-cured the bonding agent for ten seconds using a Bluephase® Style light (Fig. 7). Next, I built up a thin palatal wall using IPS Empress® Direct Enamel A2. To mimick the mamelons, I used IPS Empress Direct Dentin A2. I created the tooth neck in a slightly darker shade, IPS Empress Direct Dentin A3, to make the restoration look as natural as possible (Fig. 8) and then directly applied translucent IPS Empress Direct Trans Opal between the mamelons using an OptraSculpt® Pad (Fig. 9). I covered the incisal third with IPS Empress Direct Enamel A2 and smoothed the material again with the OptraSculpt Pad. Each layer was polymerized for 20 seconds using a Bluephase Style light. I extended the polymerization time to be certain that even the difficult-to-reach areas were reliably cured.

Reference scales on the handle of the OptraSculpt Pad assist in checking the width and length proportions during application of the materials (Fig. 10).

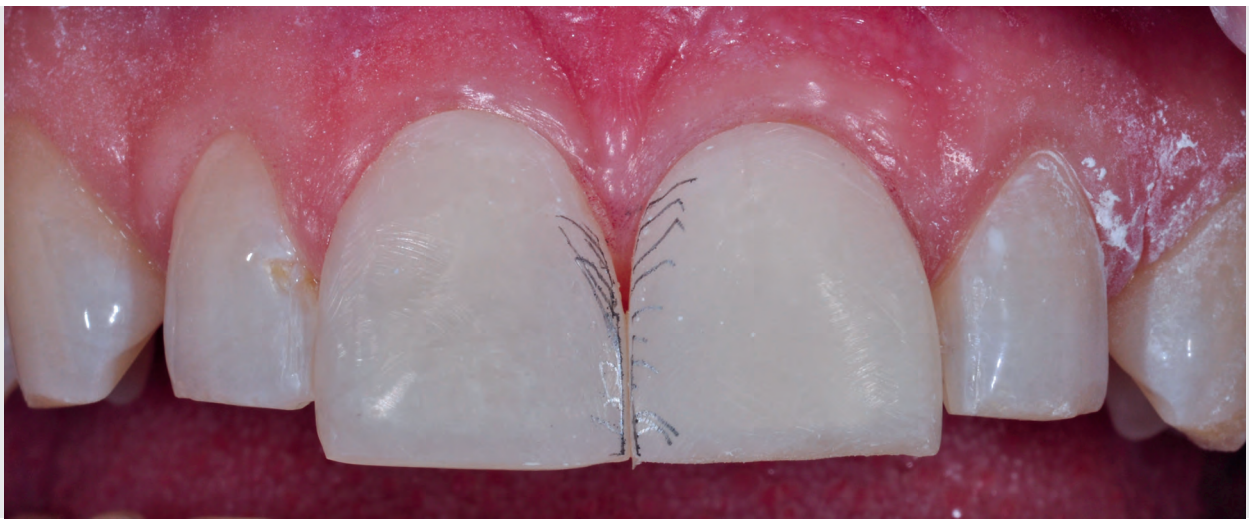


Fig. 11 Fine auxiliary markings indicating the natural curvature of the tooth assisted in finishing the restoration.

Figs 12 to 14 The newly established final situation: the teeth match the smile line and look natural. The diastemata have been successfully closed.

Finishing

In addition to contouring, finishing plays an essential part (Fig. 11). Shape and texture make the "tooth" look "alive". I used fine-grained diamonds and polishing discs for gross contouring and surface characterization. Fine contouring was achieved with a scalpel. Next, I polished the restorations with OptraPol® Next Generation, followed by final polishing with silicon carbide polishers (Astrobrush®).

Anterior canine guidance was established for protection to prevent parafunctionally-induced chippings on the composite restorations.

Additionally, I advised the patient to wear a functional splint at night.

Conclusion

Modern dentistry demands a minimally invasive approach that requires the removal of the least possible amount of tooth structure. In this, indirect all-ceramic restorations may not always present the "optimum" treatment method. Given the material systems available to date, composites can provide a high-quality option even in complex cases (Figs 12 to 14). These restorations can be accomplished in a straightforward, rapid procedure. Cost and time concerns play an additional and often significant role for the patient.

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The art of mimicking nature

Minimally invasive treatment of stained anterior teeth using IPS e.max Press ceramic veneers

Dr Stefen Koubi, Marseille, and Gérald Ubassy, Rochefort du Gard/France

The authors describe a treatment approach, which, to them, represents the advent of biomimetics in dentistry. They show how severe stains in anterior teeth can be expertly hidden by means of thin pressed ceramic veneers.

Attractive, flawless teeth have become a matter of course. Today's patients expect their teeth to be more than just functional. The appearance of teeth has become an integral component of well-being. As a result, modern dentistry no longer concentrates on simply providing curative and restorative treatment, but also offers esthetic dental solutions. Furthermore, the demand for minimally invasive treatment modalities is growing. As dental professionals, we have a responsibility to act according to ethical principles and to use the best possible treatment options. In some cases this means having to explore new possibilities and/or question customary procedures. For example, do severely stained teeth always have to be completely masked with an opaque material, or can we find a way of "covering up" the stain, but still maintaining the lifelike colour from within the tooth?

Case study

The idea behind the present case was to regard the stained tooth structure as a friend rather than a foe and to tackle the challenges playfully. Lithium disilicate in the form of the product IPS e.max® Press presented a welcome partner in this task. This material can be used to fabricate very thin veneers that are not much thicker than contact lenses, which are subsequently bonded to the teeth. The restorations impart the teeth with long-lasting, lifelike characteristics.

Analysis

The patient consulted us about a solution to cover up her severely stained teeth (upper and lower jaw) (Fig. 1). Since the treatment objective was of an esthetic nature, it was of utmost importance to adhere to the principles of minimally invasive dentistry. After the diagnosis had been made and discussed with the patient, the esthetic parameters were established. It is standard practice to document this type of case with photos taken when the jaw is at rest and in a dynamic position. The treatment plan was based on a diagnostic wax-up. Morphological criteria were of minor importance in this case, since the treatment focused on masking the stains. Only very small adjustments were made, for example, with regard to the position of tooth 12. In addition, the patient requested that the narrow diastema between tooth 11 and 21 be closed.

Fig. 1 Preoperative view: The patient wished to have the stains on her teeth covered up. Treatment with pressed ceramic veneers was planned.

Planning

We pursue biomimetic principles whenever we can and aim to cause minimal harm to healthy tooth structure. Furthermore, we strive to include the natural teeth in the treatment plan. Modern materials provide the equipment we need

Fig. 2 Minimally invasive preparation: Horizontal reference grooves were placed in order to define the penetration depth in the enamel.

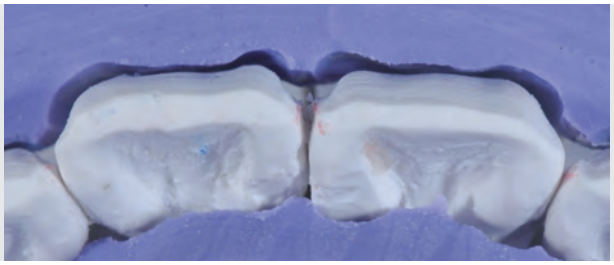


Fig. 3 Silicone matrix, which was made from the wax-up, on the model. The challenge was to effectively hide the stains, while at the same time creating a natural-looking appearance using ultra-thin restorations.

to meet this challenge. The properties of many all-ceramic products are almost identical to those of dental enamel. The materials even assume the colour of the natural tooth structure. With the appropriate techniques a natural appearance can be imparted to ultra-thin restorations. In the case at hand, we decided to make the most of the excellent light-optical properties of lithium disilicate. The low opacity of pressed ceramic, which is often considered to be a disadvantage for veneers, actually became our "friend" in this project. The conventional solution of choice would have been to treat the patient with highly opaque veneers fabricated on refractory dies (a rather complex procedure). Our approach, however, was to diffuse the stains rather than to completely mask them. The pressed lithium disilicate veneers would act like an optical filter. They would allow light to pass through but would scatter it, similarly to natural dental tissue.

Ingot selection

We were faced with the challenge of removing only a minimal amount of tooth structure and then masking the teeth and creating the illusion of natural enamel. We selected a suitable IPS e.max Press ingot before (!) we prepared the teeth, taking into account the light-optical potential of the material. In cases where stains have to be completely covered up, a highly opaque ingot should be used. A considerable amount of space, however, is required to imitate the interplay of the colours within this type of restoration. In the present case, therefore, we selected a press ingot showing low translucency (LT). We planned to characterize the framework with a subsequent layer. The decision to use a translucent ingot in order to treat discoloured dentition may seem rather unusual. Nevertheless, it was based on a careful analysis of the particular situation and the light-optical properties of the material. The idea was to have the veneers act like optical filters that would change the colour of the dentin tissue. Nature provided the inspiration: Dental enamel is NOT transparent, but translucent. It scatters light and therefore modifies the colour of the tooth.

Preparation

A silicone matrix (wax-up) was used as a reference in tooth preparation. A small but adequate amount of tooth structure was removed in the visible esthetic part of the tooth. In order to define the preparation depth in the enamel, we placed horizontal reference grooves (groove grinder, ball-shape) (Fig. 2).

The idea behind biomimetics is to recognize nature as the teacher.

Laboratory work

An optimum situation was established by means of the wax-up (Fig. 3). The ceramic restorations were produced in the next step. The ceramic veneers were fabricated according to the customary technique using IPS e.max Press LT ingots (Fig. 4). In the subsequent characterization procedure, the translucent properties of the framework structure were maintained and the brightness of the "teeth" was increased with a layering ceramic (IPS e.max Ceram). We strove to achieve a masking (saturated) effect by using bright and opaque Enamel materials. The greatest challenge in the layering process was to imitate the dentin structure, the absorption areas, the "opalescent" translucency and the "halo" effect in the incisal third of the teeth. When ultra-thin restorations are being made, it is advisable to verify the shade achieved with IPS e.max Ceram Essence materials in the stains firing process.

The pressed frameworks were approximately 0.3 mm thick. The cervical areas and the middle third of the restorations were merely coated with a thin layer of Dentin material (Deep Dentin B1). In order to achieve an illusion of depth, we applied an Effect material (Opal Effect 1) to vertical segments of the proximal areas. We placed a translucent

Fig. 4 The pressed frameworks (IPS e.max Press LT) were approximately 0.3 mm thick. We took advantage of the light-optical properties of the translucent ingots (Low Translucency).

Fig. 5 The layers were built up on the framework (light-optical filter) with different ceramic materials (IPS e.max Ceram).

Figs 6 and 7 After polishing, the thin veneers showed natural-looking translucency combined with slight opalescence and a lively interplay of colours. The appearance of the surface is influenced by the irregularities in the texture.

Dentin layer between the proximal areas – mixing ratio of 1:1 composed of unsaturated Dentin B1 and neutral Dentin. We selectively layered a mixture of Mamelon material (MM light and MM yellow-orange) in the upper third of the restoration. Below the mamelons, we placed what we refer to as an "absorption material": Opal Effect violet, a purple powder, was mixed and coloured with 50 per cent Impulse Transpa brown-grey. The difficult part of this procedure was to place the individual materials on the veneers without increasing their thickness. Finally, the layers were coated with an opalescent ceramic material (Opal Effect 4) to complete the esthetic effect. The successful outcome was dependent on the ratio in which the different materials were used: A third of the layer consisted of the mentioned materials and two thirds of the opalescent ceramic (Opal Effect 4) (Fig. 5).

The surface morphology was created according to models, which provided a reference for the tooth shape and texture. In the finishing step, we used our established "two-coloured-pencil technique" to apply the ridges and concavities. Furthermore, we incorporated very fine, almost indiscernible structures. Subsequently, the restorations were mechanically polished to ensure their smooth integration in the mouth of the patient (Figs 6 and 7).

Cementation

It is of utmost importance for the longevity of ultra-thin restorations that they be placed with the adhesive luting technique. Nevertheless, this treatment step is a daunting procedure for many dental practitioners due to previous complications with this technique. However, if a strict procedure is followed, failures can be avoided.

Try-in

- Functional: Precision fit is essential! "Our" restorations fully met this prerequisite (IPS e.max has a precision of 50 micrometres, which is ideal).
- Esthetic: The shade of the restorations was simulated with glycerine-based try-in pastes and a suitable shade was selected for the luting composite (Variolink® Veneer) (Fig. 8).

Selection of the adhesive agent

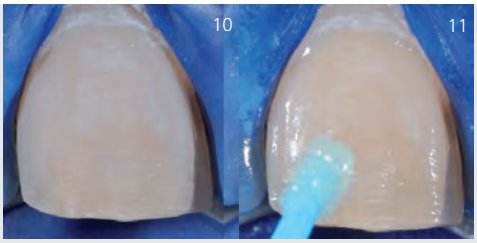
Since the retention of veneers depends entirely on the strength of the bond to the tooth structure, adhesive systems that employ acid etching should be used. They provide excellent bonding results (ExciTE® DSC).

Cementation material

Light-curing luting composites are preferred for the cementation of veneers due to their long-term esthetics and easy handling. In this case, a material was chosen which rein-

Fig. 8 Before the veneers were placed, they were tried in with glycerine-based try-in pastes to simulate the outcome and to select the suitable luting composite shade (Variolink Veneer).

Fig. 9 The shade of the prepared teeth was taken into consideration in the selection of the luting composite. The whitish Variolink Veneer High Value +2 paste was chosen. A highly translucent luting cement would have made the restorations look grey.



Figs 10 and 11 The veneers were cemented according to a sophisticated and systematic procedure.

Figs 12 und 13
The seated restorations.
The adhesive bond ensures long-lasting adhesion of the veneers.

Fig. 14
The thin veneers blend in smoothly with the orofacial environment. The result is not compromised by any stained areas. The fundamental principles of biomimetics have been fulfilled.

forced the desired light-optical qualities: the light Variolink Veneer Value +2 paste (Fig. 9). A highly translucent material would have given the veneers a greyish tinge.

Working field

We recommend the placement of a rubber dam around the individual teeth. Rubber dam isolation does not hamper the exact placement of the restorations and it has distinct benefits: The dental practitioner can concentrate on each tooth individually; the prepared tooth surfaces can be sandblasted without the patient inhaling any harmful aluminium oxide particles; and, excess composite can be removed with ease.

Bonding

The teeth were air-abraded to remove the bonding agent of the provisional restorations (Fig. 10). Next, the teeth were etched with 37 per cent phosphoric acid. Then the primer and the bonding agent were applied within 40 seconds and the surface was dried (Fig. 11). The materials were light-cured for one minute. The restorations were etched with hydrofluoric acid for 20 seconds. Next, they were carefully rinsed, conditioned with silane and coated with a light-curing bonding agent. Then the veneers were placed and excess cement was removed. Finally, the restorations were light-cured for 40 seconds at a high intensity (1200 mW/cm^2; Bluephase® 20i).

Finishing of the restorations

The rubber dam was removed and the cervical areas were carefully finished. We used a no. 12 scalpel blade in order to prevent the risk of harming the ceramic surface. Finally, the static and dynamic occlusion was checked. The results were highly attractive. The stains were hidden, but the restorations had a lifelike shade, translucency and brightness. This combination of veneer, cementation material and tooth produced a highly resistant structure similar to that of natural dentition (Figs 12 and 13).

Conclusion

Attractive, flawless teeth have become a matter of course. In the described case, pressed lithium disilicate veneers offered an efficient means of achieving a natural balance between opacity (coverage) and translucency (vitality). The restored teeth exhibit a lifelike interplay of fluorescence and brightness (Fig. 14).

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Different restorations, same material

Four anterior ceramic restorations placed with the adhesive luting technique

Dr Gil Tirlet, Paris, Hélène Crescenzo and Didier Crescenzo, Gulf of Saint Tropez/France

A thorough knowledge of the latest ceramic systems and adhesive luting techniques is all it takes to fabricate partial restorations according to biomimetic principles.

In many clinical situations, a combination of full and partial restorations is indicated. In order to fulfil (bio)mechanical, functional and esthetic requirements, it is of utmost importance to select the most suitable ceramic materials for the case at hand.

Preoperative situation

The 28-year-old patient consulted our office about "improving her smile". She was particularly concerned about the appearance of her four upper front teeth (shape, position, colour, surface texture). Unfortunately, the patient did not wish to undergo any orthodontic treatment. Theoretically, this would have offered an elegant solution to realigning both the upper and the lower tooth arch. Nevertheless, the patient's wishes must always be respected. Therefore, another approach had to be found to meet her needs.

Tooth 11 and 21 had previously been restored with PFM crowns. However, these two restorations looked very bulky. Therefore, the two lateral incisors, tooth 12 and 22, appeared to be pushed back (Figs 1 and 2). The patient had very bright teeth, which would have to be appropriately imitated by applying internal highlights (Fig. 3).

Treatment plan

On the basis of the esthetic treatment plan, a mock-up of the restoration was fabricated with a tooth-coloured composite resin. We refer to this structure as an "anterior matrix". It was used to establish the desired outcome together with the patient: The pushed-back position of the lateral incisors would be restored with veneers following minimal preparation and the central incisors with new crowns.

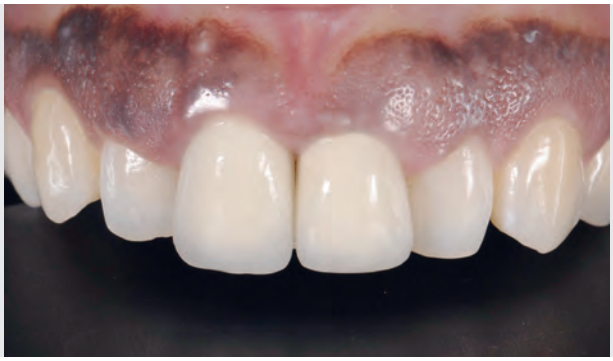

Fig. 1
Preoperative situation viewed from the front

Fig. 2
Preoperative situation viewed from the side

Fig. 3 The exceptional luminosity and brightness of the anterior teeth was established during shade selection.

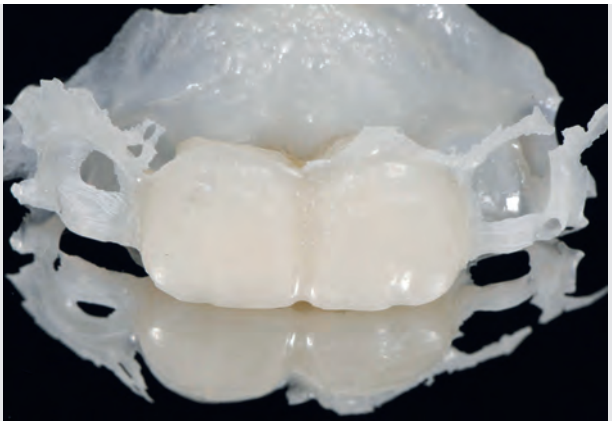

Fig. 4 The tooth-coloured mock-up gave an indication of how finely the two lateral incisors would have to be prepared.

Preparation

The lateral incisors were minimally prepared in accordance with the anterior matrix (Figs 4 and 5). The space available for the new restorations was shown to be ideal after the PFM crowns were removed from tooth 11 and 21. Furthermore, an adequate amount of tooth structure remained, which would provide biomechanical reinforcement for the two central incisors (ferrule effect) (Fig. 6). Therefore, we decided to place the new ceramic restorations according to an adhesive luting protocol.

Selection of the press ingot

The dental lab technician selected a suitable press ingot (IPS e.max® Press) based on the information that was available about this case (colour of the enamel and the tooth core, etc.) (Fig. 7).

The challenge was to select an ingot that would accommodate both the crowns for the highly chromatic and luminous central incisors and the thin veneers for the light lateral incisors (Fig. 8).

Fig. 5 The margins were finished after minimally invasive tooth preparation.

Fig. 6 View of the four prepared teeth

Fig. 7 The chroma of the prepared teeth, 11 and 21, was determined (IPS Natural Die Material shade guide). The selection of the appropriate press ingot required considerable care and deliberation ...

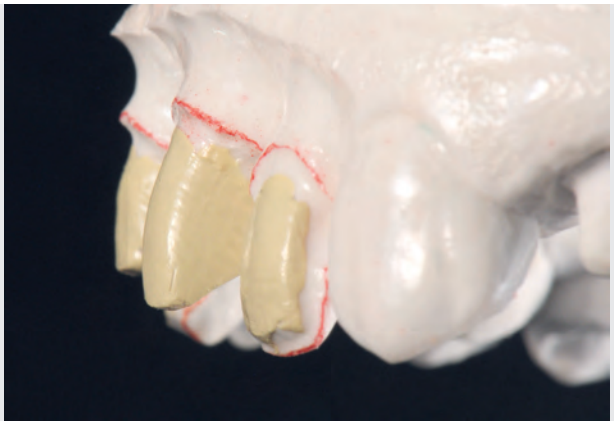

Fig. 8 ... since the restorations were of varying thicknesses. The difference in the preparation depth of the lateral and the central incisors is clearly visible.

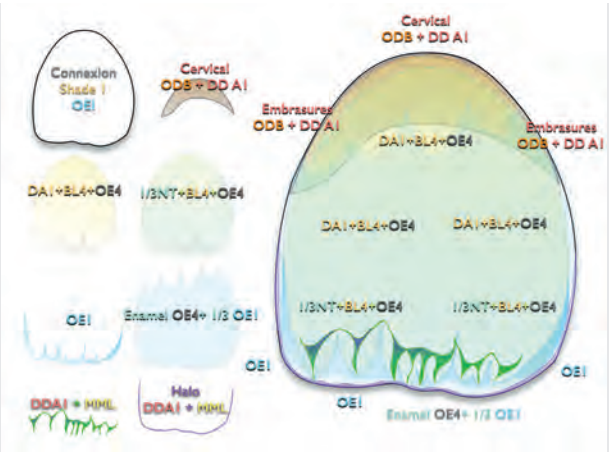

Fig. 9 A sketch of the esthetic features served as a guideline for the restoration build-up.

Fig. 10 Layering scheme taking esthetic planning aspects into consideration

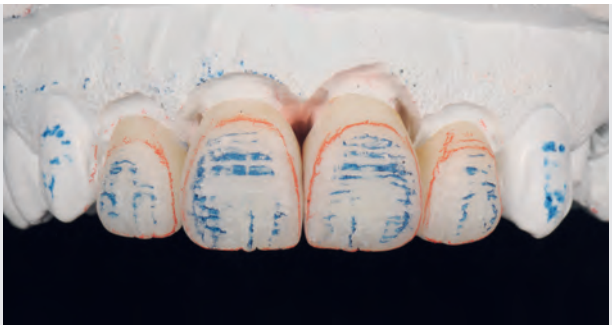

Fig. 11 Creation of the tooth shape and the surface texture on the model

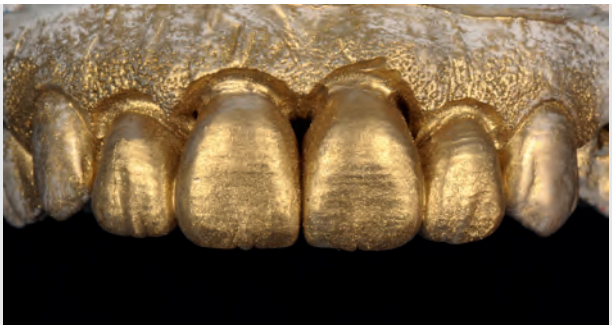

Fig. 12 The surface texture of the restorations was checked by applying a fine layer of powdered gold.

A medium opacity ingot (MO) was chosen for the following reasons. When maximum brightness is desired in restorations on intensively coloured bases, as is the case in the two incisors, we generally choose an ingot of the MO type. These ingots provide a medium level of opacity, which offers good masking properties, and a high degree of fluorescence. The minimally prepared teeth, however, do not provide a binding colour for the partial restorations. Therefore, a more translucent type of ingot would impart a greyish appearance to the relatively thick lithium disilicate veneers. Due to this second point, we prefer to use a fluorescent (MO) ingot in order to ensure the appropriate brigthness of the restored teeth. The restorations were fabricated using the familiar press technique.

Fig. 13 The four anterior restorations were seated with adhesive luting composite. As a result of the existing occlusal conditions, the incisal edge was relatively easy to create and imparted considerable personality to the smile.

Fig. 14 Final picture. The crowns and the veneers have the same colour.

Fig. 15 The black-and-white picture allows the four ceramic restorations to be assessed in terms of value.

Figs 16 and 17 The situation six months after the treatment

Due to their opaque characteristics, IPS e.max Press MO ingots are ideal for producing substructures for the restoration of vital, lightly stained teeth. They provide an excellent basis for lifelike restorations as a result of their true-to-nature fluorescence.

Veneers

Since the patient had very intensively coloured gingival tissue and dark red lips, the tooth necks had to be saturated with IPS e.max Ceram Occlusal Dentin Brown and Deep Dentin A1, despite the selected A1 shade (Figs 9 and 10). This ensured a smooth transition between the tooth necks and the restorations. A large amount of information, which was extremely helpful in the subsequent finishing work, was conveyed to the dental laboratory by means of close-up pictures of the teeth and gingival tissue as well as of the patient's face (portraits showing various natural facial expressions). The surface texture and the shape of the teeth (Figs 11 and 12) were carefully recreated. Then the restorations were prepared for placement.

Conclusion

When we seated the restorations, we saw that our treatment strategy had proved to be a success. The teeth blended in smoothly with the dentition. The overall impression was very harmonious (Fig. 13). The ingot which had been selected also showed to be ideal for this case. No difference in the shade could be distinguished between the two crowns on the central incisors and the adjacent veneers (Figs 14 and 15). A highly esthetic solution was achieved with minimally invasive tooth preparation (Figs 16 and 17).

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Simply more choice

Monolithic anterior IPS e.max CAD crowns

Jonathan L. Ferencz, DDS, FACP, and Marisa Notturno, New York/USA

Given their translucency and shade characteristics, modern ceramic materials such as lithium disilicate can be efficiently applied to achieve convincing prosthetic results.

There is no denying the success of all-ceramic materials (e.g. IPS e.max® CAD). As awareness of CAD/CAM and digital dental technology increases, many dentists and dental laboratories are realizing new benefits for themselves and their patients, such as superior strength, accuracy, durability and cost-effectiveness. In-office manufacturing systems combined with modern all-ceramic materials afford dentists new opportunities to meet the needs of their patients. This case presentation describes the digital treatment planning, restoration design, milling and characterization steps to produce all-ceramic anterior crowns. The challenging demands of this case were met with a streamlined approach that delivered highly accurate and esthetically pleasing results.

Case presentation

A 42-year-old man presented with extensive demineralization and caries on his maxillary anterior teeth (Fig. 1). After the patient had been carefully diagnosed and given detailed advice, a treatment plan was established: Teeth 13 to 23 were to be restored with all-ceramic crowns. The teeth were prepared and temporarily restored with provisional crowns (Fig. 2). Ten days later, the patient was seen for a follow-up, at which time he felt generally comfortable and pleased with the esthetics of the temporary restorations. He only requested a few modifications that involved some minor recontouring and reshaping of the incisal edges and incisal embrasures.

Once these adjustments were made, the patient was completely satisfied with the appearance of his temporaries and it was therefore decided to use them for the digital "mock-up" of the final crowns (Fig. 3). A digital record of the oral situation was obtained with an intraoral scanning device (3Shape Trios® Color, 3Shape Denmark) (Fig. 4). The opposing teeth were included in the scan to enable a digital bite registration. Additionally, this was also the ideal time to determine the tooth shade with all its individual characteristics.

The temporaries were then removed, the patient was anaesthetized with local anaesthetic, and the gingival tissues were gently retracted using a retraction cord (Siltrax® Plus, Pascal International, USA), after which the preparations were refined. Since the plan was to mill lithium disilicate crowns (IPS e.max CAD), it was essential to eliminate any sharp edges or line angles from the preparations. Sharp edges could make the milling process very challenging and cause major fitting problems. The intraoral scanner was again used to digitally scan the prepared teeth. An interocclusal scan was obtained to enable the articulation with the opposing dentition (Fig. 5). The data files were then transferred to the 3Shape design system and opened using the DentalDesigner™ program.

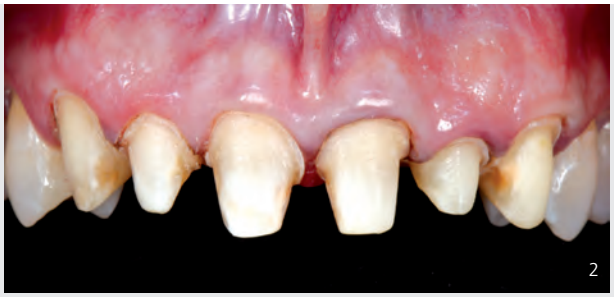

Fig. 1
Close-up retracted preoperative view: extensive demineralization and caries on teeth 13 to 23

Fig. 2
Teeth 13 to 23 were prepared for crown restorations.

Fig. 3
Once minor alterations had been made, the patient was satisfied with the temporaries.

Digitally designing and milling the restorations

When fabricating a CAD/CAM reconstruction that involves more than two teeth, it is helpful to use a physical model on which proximal and occlusal contacts can be verified. The Model Builder™ module of the 3Shape Design Center was used to design and order the model. The model design data were sent to Custom Milling Center (CMC, Arvada, USA) and printed out in high definition using 3D printer technology (ULTRA^2 HD, envisionTEC, Germany). The maxillary and mandibular models were extraordinarily accurate and had a very smooth, gypsum-like surface finish.

The digital design of the six full-coverage crowns began while awaiting arrival of the models. First, the manufacturing parameters were set in the software to control individual preferences (thickness of the restoration, cement spacer, occlusal contacts, proximal contacts, drill radius). These parameters may vary by individual milling machines and/or milling centres.

The scan of the temporary restorations served as a pre-preparation scan. The design software automatically morphed the proposed crown restoration into the scan of the temporaries. Generally, the crown design can be modified at this stage; however, in this case there was no need for changes. The design software uses different colours to help spot differences between the final crown design and the mock-up scan (temporary restorations) (Figs 6 and 7).

Fig. 4 Digital scans of the temporaries (3Shape Trios Color) served as a "mock-up" of the final restoration.

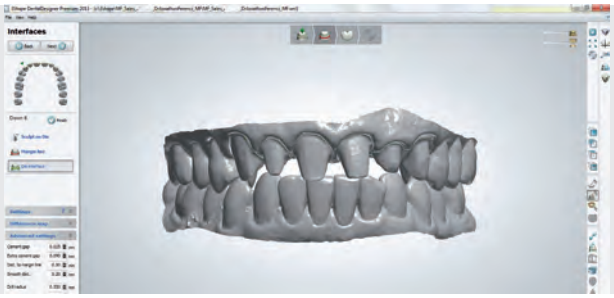

Fig. 5 Scan of the prepared teeth and opposing dentition

Fig. 6 Colours in the design software indicate differences between the final crown design and the temporaries (proposed crown design: yellow; pre-preparation scan: grey).

Fig. 7 Final restoration design

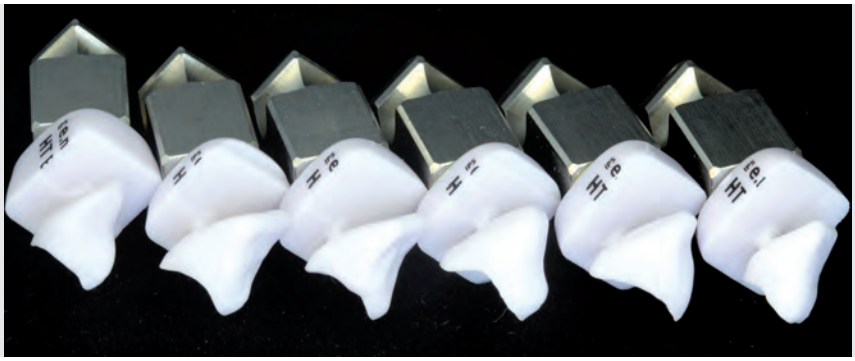

Fig. 8
Milled crowns in the "blue stage" (IPS e.max CAD restorations on their spindles)

Fig. 9
Printed 3D model

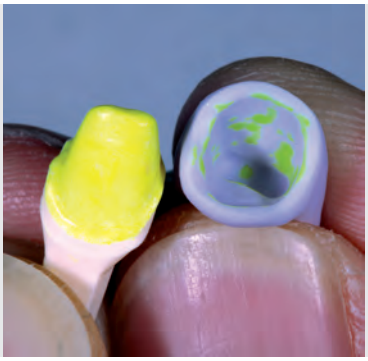

Fig. 10
The fit of the crowns was checked on the dies. Minor changes may be necessary if the preparations contain sharp angles or edges.

Next, attention was given to selecting the shade and translucency of the IPS e.max CAD blocks.

The decision on an appropriate block depends not only on the final selected shade of the restoration but also on the shade of the prepared tooth. The effect of the prepared tooth shade on the final shade should not be underestimated.

In this case, the patient wanted a fairly light shade for his crowns. As his preparations were not badly discoloured, a translucent block (IPS e.max CAD HT, shade B1) was selected. IPS e.max CAD blocks for in-office milling are available in two degrees of translucency: HT = High Translucency and LT = Low Translucency. When selecting a block for monolithic crowns, using a light-coloured block with a high translucency and adding characterizations with stains and shades to achieve the final shade is preferable. This technique was described in great detail by Lee Culp [1].

The six crowns were milled using an in-office CAD/CAM unit (E4D®, E4D Technologies, USA) (Fig. 8).

Refining shape and esthetics

Upon receipt of the 3D printed model, the restorations were tried for fit (Fig. 9). Milled IPS e.max CAD restorations usually fit accurately on the dies and internal adjustments are required only occasionally, especially if the teeth are prepared with sharp angles or edges. If this is the case, it is advisable to mill the crowns using the "detailed mode" (rather than the "standard mode"). The detailed mode utilizes thinner diamond drilling tools that are designed to reach narrow areas of the crown but take somewhat longer to mill. Milling in detail mode is preferable for all anterior

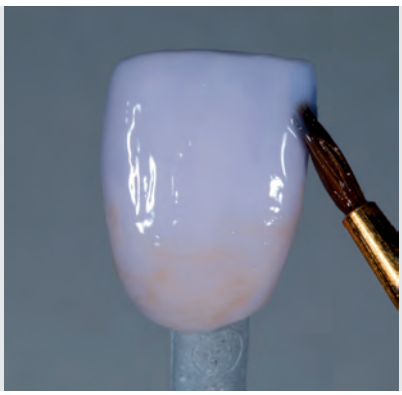

Fig. 11 Here the surface texture is already established. Glazing was accomplished using IPS e.max CAD Crystall./Glaze Pastes.

Fig. 12 Finishing after crystallization firing. Polishing points were used for prepolishing.

Fig. 13 The finished crowns were further polished with a diamond polishing paste and a soft bristle brush.

Fig. 14 Retracted view of the seated anterior maxillary monolithic crowns (IPS e.max CAD)

restorations even if the milling process takes longer. The blue (pre-crystallized) crowns were seated on their respective dies and checked on the articulated printed models (Fig. 10).

Coloured markings applied on the labial surface of the crown to indicate the desired surface texture (perikymata, marginal ridges, etc.) provided valuable help when finishing the crowns. A series of diamond burs was then used to achieve the desired surface characteristics. After verifying the proximal contacts and occlusion one more time, the crowns were prepared for crystallization firing. This process was combined with staining and glazing using glaze and shade pastes (IPS e.max CAD Crystall./Glaze and Shade Pastes) in the gingival and incisal area (Fig. 11). Intensive colour characterizations were achieved using IPS e.max CAD Stain Pastes, a process that frequently requires multiple firings.

The crowns were polished using fine polishing points (Dialite® LD Polishing Points, Brasseler, USA) (Fig. 12) followed by a soft bristle brush and diamond paste (Pasta Grigia, anaxdent GmbH, Germany) (Fig. 13). The monolithic crowns were now ready for try-in on the patient.

Seating

Proximal contacts, marginal fit and occlusion – all aspects were meticulously assessed and found to be excellent. The young man was delighted with the esthetic result. Final cementation was performed using a resin-reinforced glass ionomer cement (Fuji Plus, GC America, USA) (Fig. 14).

Conclusion

Digital dental technologies make it possible to deliver esthetically pleasing monolithic restorations even in the anterior region. In the case presented here, the shape, fit and esthetics completely met the patient's expectation. By digitally "cloning" the temporary restorations, carefully selecting the ideal shade of the CAD lithium disilicate blocks and then staining and glazing the milled restoration, the dental team was able to undertake a streamlined fabrication process and deliver optimum results.

Literature:
[1] Culp L. Personal communication, 2013.

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