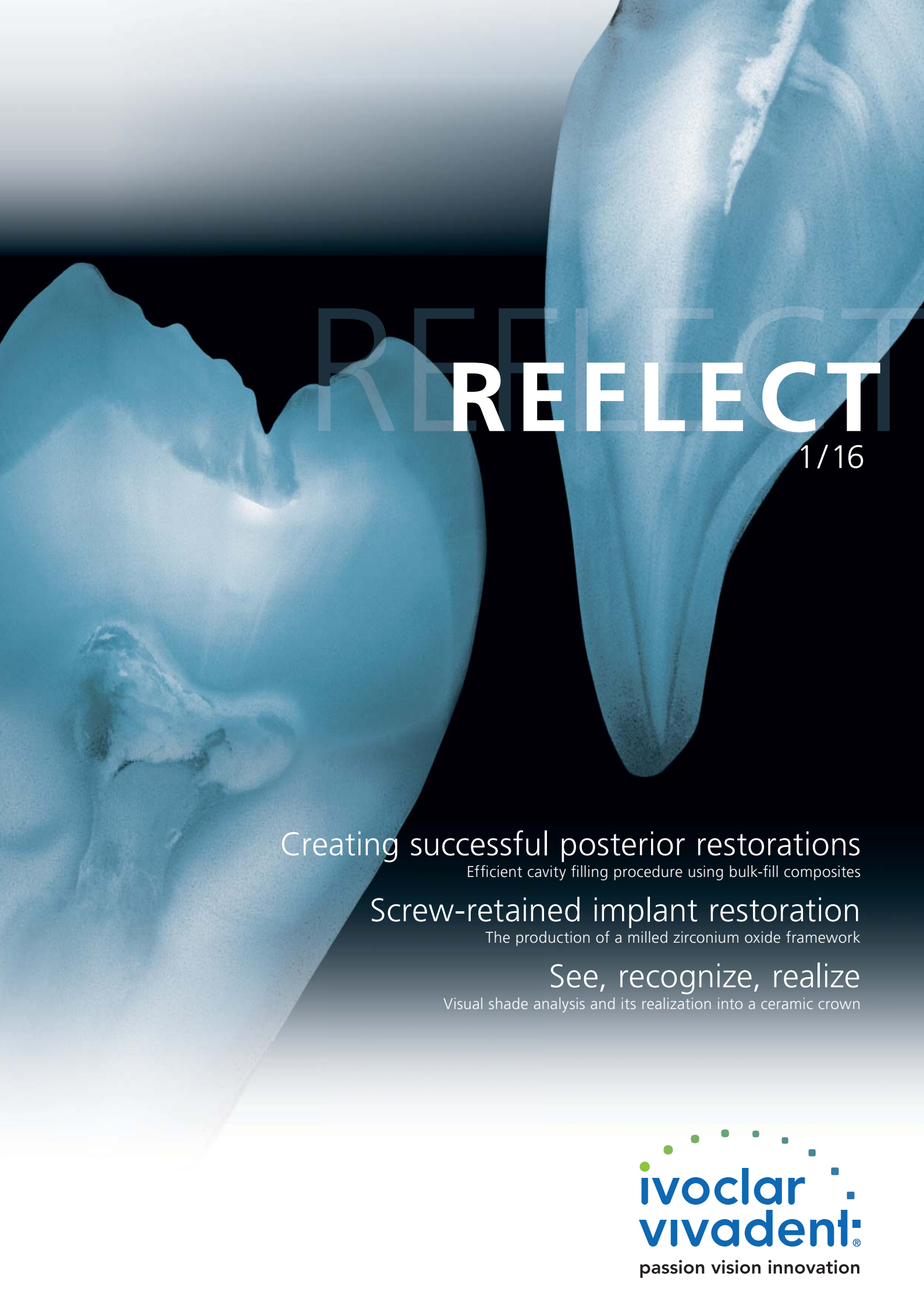

REFLECT

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Creating successful posterior restorations

Efficient cavity filling procedure using bulk-fill composites

Screw-retained implant restoration

The production of a milled zirconium oxide framework

See, recognize, realize

Visual shade analysis and its realization into a ceramic crown

ivoclar vivadent®

passion vision innovation

Dear Readers

Welcome to the first edition of Reflect in 2016!

The landscape of the dental market is as competitive as ever and patients around the world expect esthetic solutions provided by skilled professionals using innovative and reliable dental materials and processes.

At Ivoclar Vivadent we are committed to continue to bring you, our valued customers, innovations that will create tangible benefits in your surgery or laboratory for the benefit of you and your patients.

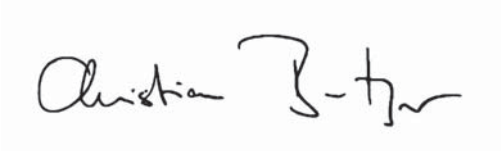
Those cutting-edge products and processes are delivered to you by our growing network of Ivoclar Vivadent subsidiaries and designated dealers around the world. We are passionate about bringing you the best customer service, continuous education and support.

The wide range of our offering is illustrated in this edition of Reflect.

Read about first hand experiences from around the world with the sculptable Tetric EvoCeram Bulk Fill, the top of the line IPS Empress Direct composite material, our tried and tested Wieland Zenostar zirconia material and of course about IPS e.max, our world leading lithium disilicate material.

I hope you will enjoy reading this new issue of Reflect!

Yours sincerely



Christian Brutzer
Global Region Head – Asia/Pacific

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PUBLISHER'S CORNER

Publisher
Ivoclar Vivadent AG
Bendererstr. 2
9494 Schaan/Liechtenstein
Tel. +423 / 2353535
Fax +423 / 2353360

Publication
3 times a year

Total circulation
63,100
(Languages: German, English, French, Italian, Spanish, Russian, Greek)

Coordination
André Büssers
Tel. +423 / 2353698

Editorial office
A. Büssers, Dr M. Dieter, Dr R. May, N. van Oers, T. Schaffner

Reader service
info@ivoclarvivadent.com

Production
teamwork media GmbH, Fuchstal/Germany

Efficient and esthetic restoration of posterior teeth

A new era of bulk-fill materials

Dr Rafael Piñeiro Sande, Cambados-Pontevedra/Spain

With the introduction of a flowable bulk-fill composite to complement its sculptable posterior composite Tetric EvoCeram Bulk Fill, Ivoclar Vivadent has taken bulk filling to the next esthetic level.

Today, composite resins are routinely used as posterior restoratives in dental clinics [1, 2]. That is why dentists have been eagerly awaiting improvements related to these materials and the associated techniques which will allow them to offer their patients more efficient treatment modalities. In response to these expectations, conventional composites have been further developed. Materials known as bulk-fill composites have lately entered the market. These restoratives are placed using a simple protocol to produce very attractive results in posterior teeth [3].

The marginal adaptation of bulk-fill restoratives is similar to that of layered composites [4]. In addition, these materials show similar/lower shrinkage compared with conventional composite resins and they offer a high depth of cure in increments of up to 4 mm [5]. Nevertheless, in order to obtain successful results, it is important to observe the light-curing instructions of the manufacturer [6].

The flowable bulk-fill composites are generally used as a base layer in Class I and II restorations [7-9]. They are subsequently covered with a layer of conventional or bulk-fill composite.

Due to their stiff consistency, sculptable bulk-fill composites are suitable for recreating natural morphology (fissures, cusps, etc.).

The next level

Tetric EvoCeram® Bulk Fill, which was introduced in 2011, is a sculptable posterior composite that can be placed in layers of up to 4 mm. Its chemical composition is based on that of the time-tested Tetric EvoCeram universal composite, which has an excellent 10-year clinical track record [10]. The patented light initiator Ivocerin® contained in these products sets these materials apart from other bulk-fill composites [11-13]. Due to Ivocerin, composite layers of up to 4 mm can be reliably cured.

The new Tetric EvoFlow® Bulk Fill takes the esthetics of bulk-fill composites to the next level. This flowable posterior composite can be used as a base layer in Class I and Class II restorations and as a filling material in deciduous teeth.

Fig. 1:
Class II restoration in tooth 36 and 37 showing leakage on the mesial and distal sides

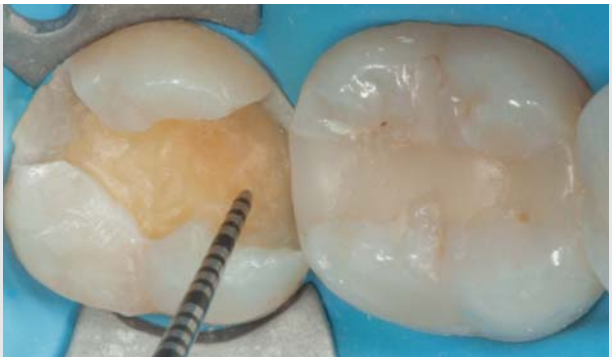

Fig. 2: After the removal of the old filling: cavity depth of more than 5 mm

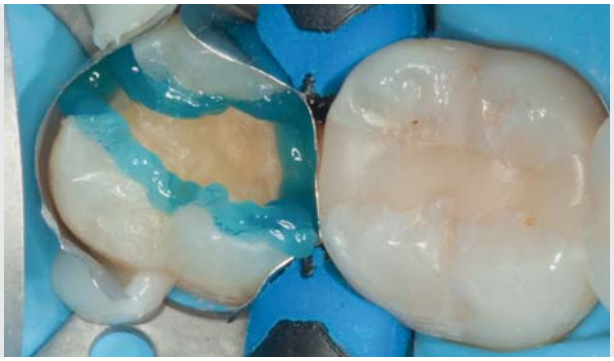

Fig. 3: Selective enamel etching with Total Etch for 30 seconds

Fig. 4: Application of Adhese Universal to the tooth structure

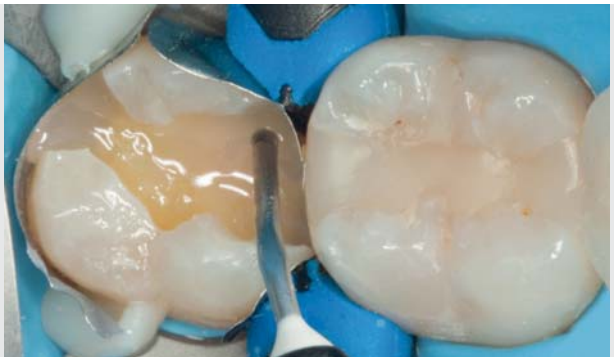

Fig. 5: Placement of Tetric EvoFlow Bulk Fill on the mesial and distal sides and subsequent polymerization of the composite with Bluephase Style for 10 seconds

As a result of the patented light initiator Ivocerin in combination with the Aessencio® technology developed by Ivoclar Vivadent, up to four-millimetre increments of this composite can be reliably light cured. During the polymerization process, the translucency of the restorative drops from 28 % to < 10 %. Consequently, even stained dentin tooth structure can be successfully concealed. Furthermore, this new material has convenient self-levelling properties, and it optimally adapts to cavity walls [14]. Both types of composites show reduced shrinkage stress, since they contain an elastic resinous filler, also known as a "shrinkage stress reliever", in addition to the standard fillers. Consequently, the features of these composites are similar to those of conventional layered composites [15]. The highly reactive light initiator and the light sensitivity filter, both of which have been patented, impart these two restoratives with a longer working time compared with other composites [16] under the usual light conditions of the dental office. Nevertheless, they require only short polymerization [17].

Fig. 6: Visible change of the translucency of the material during the polymerization process due to the Aessencio technology. This promotes the integration of the restoration in the surrounding tooth structure.

Clinical case: IPS Empress Direct vs Tetric EvoCeram Bulk Fill as a capping layer

The patient presented with Class II restorations in tooth 36 and 37 showing leakage on the mesial and distal sides (Fig. 1). The treatment plan entailed restoring tooth 36 with an initial layer of Tetric EvoFlow Bulk Fill and a covering layer of Tetric EvoCeram Bulk Fill. The highly esthetic composite IPS Empress® Direct was chosen as a covering layer for tooth 37 in order to assess the esthetic and process-related differences.

Restoration of tooth 37

The old restoration was removed from tooth 37 and the lesion was cleaned. A cavity depth of more than 5 mm was established in the process (Fig. 2). Next, the dental enamel was etched with phosphoric acid (Total Etch) for 30 seconds (Fig. 3). The Adhese® Universal bonding agent was applied with the brush tip of the VivaPen®, the delivery form for efficient application (Fig. 4). Subsequently, the bonding agent was distributed with blown air and then polymerized with Bluephase® Style for 10 seconds. Then, a layer of Tetric EvoFlow Bulk Fill was applied on the mesial and distal sides of the cavity and polymerized for 10 seconds with Bluephase Style (Fig. 5). As a result of the Aessencio technology, the translucency of the material changed during the polymerization process. This improved the integration of the restoration and maximized the esthetic effect from within the restoration (Fig. 6).

Fig. 7:
Tooth 37 was built up layer by layer ...

Fig. 8:
... with the highly esthetic IPS Empress Direct.

Fig. 9:
High-gloss finishing of the restoration in tooth 37 (Tetric EvoFlow Bulk Fill and IPS Empress Direct) with an Astrobrush polishing brush

Next, the restoration was built up in layers using IPS Empress Direct. OptraSculpt® instruments were used to shape the composite (Figs 7 and 8). The restoration was polished to a high-gloss finish with Astrobrush® silicon carbide brushes (Fig. 9).

Restoration of tooth 36

The old composite restoration in tooth 36 was removed. The resulting cavity was also more than 5 mm deep (Fig. 10). The tooth was pretreated in the same way as tooth 37 (Figs 11 and 12). Subsequently, the flowable Tetric EvoFlow Bulk Fill was applied to the mesial and distal sides of the cavity (Fig. 13). The restoration was cured with Bluephase Style for 10 seconds. The sculptable Tetric EvoCeram Bulk Fill was applied as the last volume replacement layer. OptraSculpt instruments were used to shape the desired occlusal anatomy (Figs 14 to 16). The restorations showed comparable results when they were polished to a high-gloss finish with Astrobrush (Fig. 17). Topical fluoride (Fluor Protector S) was applied as a preventive measure as soon as the restorations were completed (Fig. 18).

Fig. 10:
Following preparation, the cavity in tooth 36 was more than 5 mm deep.

Fig. 11:
Enamel etching with Total Etch for 30 seconds

Fig. 12:
Application of Adhese Universal on the tooth structure

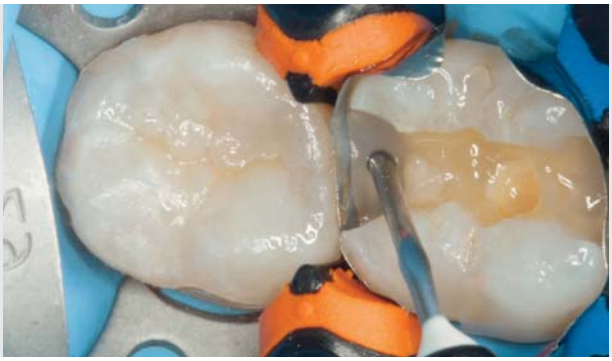

Fig. 13: Dispensing of Tetric EvoFlow Bulk Fill on the mesial and distal sides of the cavity and subsequent polymerization with Bluephase Style for 10 seconds

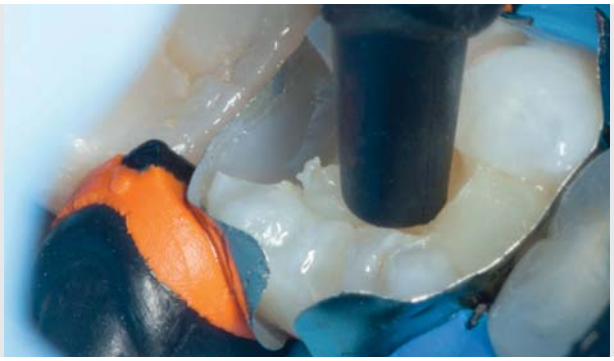

Fig. 14: Placement of a base layer using Tetric EvoCeram Bulk Fill

Fig. 15: OptraSculpt was used to shape the occlusal surfaces …

Fig. 16: … until the desired anatomy was obtained.

Fig. 17: Result: Comparable esthetics of the restorations in teeth 36 and 37

Fig. 18: Fluor Protector S was applied as a preventive measure at the end of the treatment.

Conclusion

The restorative materials Tetric EvoFlow Bulk Fill and Tetric EvoCeram Bulk Fill can be reliably used in the posterior region. The esthetic properties of these bulk-fill restoratives are comparable to those of conventional composites. Their clinical application protocol is easy, practice-oriented and efficient.

Literature available from the editors on request

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Creating successful posterior restorations

Efficient cavity filling procedure using bulk-fill composites

Dr Michael J. Koczarski, Woodinville/USA

Ensuring that posterior restorations avoid polymerization shrinkage and microleakage by utilizing modern bulk-fill composites reduces the risk for secondary caries and failed restorations.

Replacing a failing posterior restoration can be challenging for clinicians. The treatment requires them to recreate a restoration that offers not only a tight marginal seal and appropriate functionality but also esthetic anatomical contours. Using a conventional incremental layering technique may lead to an inadequate marginal seal and air entrapments between the composite layers due to polymerization shrinkage stress. The risk for secondary caries rises. Here, bulk-fill composites offer a unique alternative. They require minimal preparation, enable an efficient cavity filling procedure and can be sculpted for anatomical contours due to their stable consistency. By creating what is known as a hybrid layer and by utilizing an adequate bulk-fill composite, clinicians can achieve posterior restorations with excellent esthetics, anatomical contours and minimal risk.

Creating a hybrid layer

After the removal of caries, an adhesive should be applied and a hybrid layer created to ensure appropriate adhesion between the dentin, enamel and bulk-fill composite. By utilizing a 30–40 % phosphoric acid solution, clinicians can etch the enamel and condition the dentin simultaneously. The resulting retentive pattern on the tooth surface is ideal for the micro-mechanical retention of the filling [1]. The total-etch technique dissolves the smear layer and demineralizes the dentin surface, ensuring optimal adhesion [2, 3]. However, conditioning the dentin can occasionally lead to hypersensitivities. To avoid this complication – which affects between 5–7 % of all adults [4] – Telio® CS Desensitizer is recommended. This product reduces dentin hypersensitivity and postoperative sensitivity. By combin-

Fig. 1:
Recurrent marginal caries on tooth 37 and distal radiographic caries on tooth 36

ing two essential components (polyethylene glycol dimethacrylate, glutaraldehyde), it prevents further interaction with the materials used in the treatment.

A fluoride-releasing bonding agent (ExciTE® F) then provides the adequate adhesion between the tooth structure and composite material. ExciTE F creates a transition between the hydrophilic and hydrophobic tooth structure and bonds to the composite. With hydrolytically stable monomers, the bonding agent comprises less solvent content than other adhesives, facilitating thorough polymerization of the adhesive resin layer. ExciTE F offers convenient delivery with the VivaPen®. It releases fluoride to reduce dentinal fluid movement and post-operative sensitivity. Studies have demonstrated that using this total-etch technique is clinically successful [5, 6].

Fig. 2: The defective amalgam restorations and gross decay were removed first.

Fig. 3: Then, the outer caries-infected dentin layer was taken off.

Successful posterior restorations with bulk fill

Once a hybrid layer is created, the bulk-fill composite (Tetric EvoCeram® Bulk Fill) is applied into the cavity. Adhesive direct posterior restorations have the tremendous benefit that they only necessitate removal of decayed tooth structure.

Modern bulk-fill materials must exhibit a variety of characteristics, including low shrinkage stress, optimal marginal integrity, high strength as well as excellent polishing properties and esthetics.

No matter whether applied in one increment or several, these materials must offer adequate working time to sculpt and complete the restoration. The goal is to achieve a natural-looking shape, esthetic colour match and durability.

Avoiding polymerization shrinkage

Shrinkage stress may occur as the composite polymerizes. To overcome this problem, the incremental layering technique has been introduced. However, this technique is time consuming and it involves the risk that air may be trapped between the individual layers. By contrast, bulk-fill composites are especially designed to be cured in one increment. They shorten the restoration treatment time and improve the efficiency of the dental practice. Tetric EvoCeram Bulk Fill is a mouldable composite that achieves a complete cure in layers of up to 4 mm [7], eliminating the need for incremental layering in many cases.

Tetric EvoCeram Bulk Fill is a nanohybrid composite material. Given its small filler particles, the material demonstrates high wear resistance and low surface roughness and is easy to polish to a high gloss. A special filler, known as shrinkage stress reliever, reduces the shrinkage strain generated during polymerization to prevent marginal gaps.

Working time and esthetics

The new Ivoclar Vivadent patented light initiator, Ivocerin®, allows Tetric EvoCeram Bulk Fill to cure faster and deeper than other composite materials. Coupled with the shrinkage stress reliever, these two components enable an ideal marginal integrity. A further advantage of the light-initiator, together with a light sensitivity filter, is the unique combination of extended working time with faster curing time. Given its smooth consistency, the composite can be applied and contoured easily with conventional instruments. Tetric EvoCeram Bulk Fill is also designed to match the refractive index of the fillers and monomers to enhance the "chameleon effect". As a result, the restoration harmoniously integrates with the natural dentition.

Case study

A 45-year-old female presented with recurrent caries on tooth 37 and distal radiographic decay on tooth 36 (Fig. 1). A rubber dam was placed to isolate the decayed teeth. First, the decay and failing amalgam fillings were removed. Staining was still visible on the exposed dentin (Fig. 2), from which at the next step the outer caries-infected layer was removed (Fig. 3). The preparations were suitable for direct

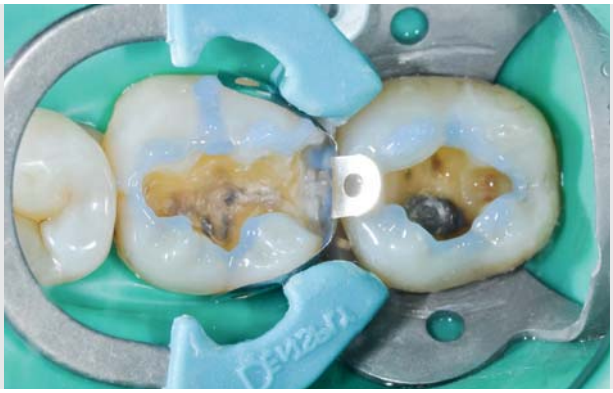

Fig. 4: A sectional matrix was placed and then the enamel was etched for 5 seconds (Total Etch).

Fig. 5: The preparation (dentin) was etched for an additional 10 seconds. This yielded 15 seconds of enamel and 10 seconds of dentin etch time.

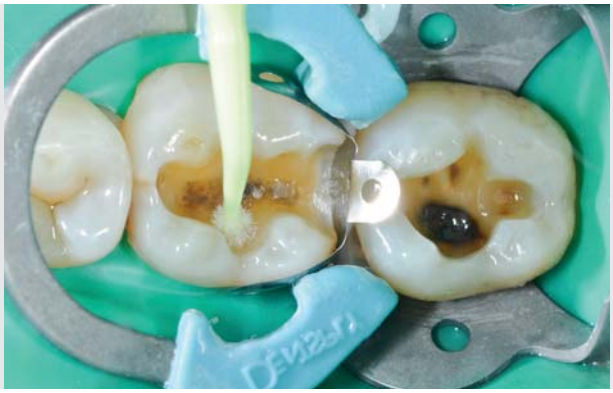

Fig. 6: After rinsing, Telio CS Desensitizer was placed for 20 seconds to close dentin tubules and reduce hypersensitivities.

Fig. 7: Application of bonding agent to the prepared surfaces of tooth 36

Fig. 8: The bonding areas were shiny, indicating that an optimal hybrid layer had formed.

Fig. 9: Tetric EvoCeram Bulk Fill was placed in shade ^{IV}A and packed with a ball burnisher.

Fig. 10: The restorations were contoured with the pointed end of a P1 plugger to achieve the desired anatomical contours.

Fig. 11: A flame-shaped diamond was utilized to finish the contours after the matrix band had been removed.

Fig. 12: Composite restoration at 1-week postoperative: tight marginal seal, anatomical contours and natural shade

restorations, as the isthmus widths were in the one-third range of the occlusal table.

Tetric EvoCeram Bulk Fill was selected for the restorations due to the above-mentioned advantages. The patient is typically assigned to one of three categories to determine the shade: universal shade A (^{IV}A), universal shade B (^{IV}B) or white for deciduous or bright teeth (^{IV}W). A universal shade (^{IV}A) was chosen for the present case. A sectional matrix was applied around tooth 36 and the total-etch technique was utilized. The etchant (Total Etch) was applied to the enamel margin for 5 seconds, and then additional etchant was applied to etch the remaining preparation for an additional 10 seconds (Figs 4 and 5). This procedure yielded a reaction time of 15 seconds for the enamel and 10 seconds for the dentin. After thorough rinsing, Telio CS Desensitizer was applied to avoid dentin sensitivity after treatment (reaction time: 20 seconds) (Fig. 6). Next, ExciTE F bonding agent was applied and allowed to react for 20 seconds (Fig. 7) and then light-cured for 10 seconds at a light intensity of more than 500 mW/cm^2. In the process, the final hybrid layer was created. All bonded areas were shiny and ready for the direct restorative material (Fig. 8).

Tetric EvoCeram Bulk Fill was evenly distributed in the cavity using a ball burnisher (Fig. 9). Final sculpting occurred with the pointed end of a P1 plugger to achieve the desired anatomical form (Fig. 10). The composite was light-cured for 10 seconds at a light intensity of 1,000 mW/cm^2. After removing the sectional matrix band, the restoration demonstrated only little excess to remove and finish. This step occurred with a 40-micron flame shaped diamond to achieve anatomical contours (Fig. 11). The restorations were then polished to a final gloss. The patient was completely satisfied with the final result (Fig. 12).

Conclusion

Direct posterior restorations can be predictably and esthetically achieved by creating a hybrid layer and utilizing an advanced bulk-fill composite. The hybrid layer with a total-etch technique provides an ideal foundation to ensure that a reliable bond forms between the tooth structure and composite. Placement of Tetric EvoCeram Bulk Fill minimizes polymerization shrinkage and shrinkage stress, resulting in a durable restoration with beneficial marginal integrity. The technique described above reduces the likelihood of secondary caries and provides functional and esthetic results.

Literature available from the editors on request

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Screw-retained implant restoration in the edentulous maxilla

Working document for the production of a milled zirconium oxide framework
Dr Octavian Fagaras, Bucharest, and Milos Miladinov, Timișoara/Romania

When veneering zirconium oxide frameworks, manual dexterity and a profound knowledge of the materials is required. The correct use of the materials is decisive for success.

A screw-retained and therefore conditionally removable restoration is a proven concept for the implant prosthetic treatment of an edentulous maxilla. Zirconium oxide is a framework material which can support a long-lasting result. State-of-the-art zirconium oxide such as Zenostar® T (Wieland Dental) and innovative ceramic veneering systems (IPS e.max® Ceram) enable natural looking prosthetic restorations to be achieved in an efficient way. In principle, zirconium oxide is a sophisticated material which requires correct and skilled application.

Introduction to a patient case

An implant supported, screw-retained bridge was planned for the edentulous maxilla. Based on defined reverse planning, six implants were inserted in the patient's jaw. After the healing phase, the implants in the visible region were provided with transversal screw-retained abutments. In the molar region the final bridge restoration would be occlusally screw-retained.

Important parameter for framework production

A set-up of the planned restoration was used as a basis for the CAD/CAM supported production (Zenotec, Wieland Dental) of the zirconium oxide framework. After digitalization in the design software the framework shape was reduced as in the cut-back technique. This method created sufficient space for the veneer. The digital structure was first milled in wax so that the fit and precision could be checked (Fig. 1). Subsequently the framework was milled from the Zenostar T disc. During framework construction it was necessary to include sinter drops as an occlusal support for the restoration so that distortion would be prevented during sintering in the Zenotec sintering furnace. In doing so, the restoration was not to be separated from the occlusal tongue (Fig. 2). Unwanted sintering distortion was avoided with this method.

The sintering process was carried out in the compact high temperature Zenotec Fire P1 sintering furnace, which is supplied with pre-installed programs. This sintering furnace can also be freely programmed so that other sinter programs can be used. We selected the "long program". The heating-up and cooling-down phase was set as long as possible in order to achieve an exact result. Caution: The sintering time should not be shortened.

After sintering the framework had the required fitting accuracy. The restoration was perfectly supported with the occlusally positioned sinter drops (Fig. 3).

Fig. 1: The structure milled in wax to check the fit

Fig. 2: The framework was fabricated using zirconium oxide (Zenostar).

Fig. 3: Sintering the framework. Small sinter drops support the framework during sintering.

Fig. 4: Checking the fit of the titanium sleeves after sintering

Fig. 5: Comparison between the wax structure and the sintered framework

The titanium sleeves can be easily inserted into the framework (Figs 4 and 5).

The recommended sintering program:
- 20–900 °C for 1 h 30 min (600 °C/h)
- Holding time 900 °C for 30 min
- 900–1 450 °C for 2 h 45 min (200 °C/h)
- 1 450 °C for 2 h
- Cooling 600 °C/h from 1 450 to 900 °C
- 900–300 °C for 1 h 12 min

Preparing for veneering

The next working steps not only required manual dexterity but also knowledge of the material firing parameters and furnace settings.

> Zirconium oxide is a poor heat conductor compared to other framework materials, so the heating rate must be correspondingly low.

This is the only way to ensure a balanced temperature distribution in the bonding area between the framework and the veneer. This in turn results in a sound bond as well as uniform shrinkage of the ceramic layer. Slow cooling of the restoration prevents the risk of tension in the fired restoration, which therefore minimizes the risk of delamination. The exact fit of the restoration justifies the long firing time.

Fig. 6: The fired framework with IPS e.max Ceram ZirLiner ready for veneering

Caution: The programs must be adjusted accordingly before the ZirLiner bake (IPS e.max Ceram ZirLiner):
- Long pre-heating time
- Long cooling-down time

Ceramic system and framework

Our preferred veneering material (IPS e.max Ceram) consists of low-fusing nano-fluorapatite. The material has a crystal structure similar to that of natural dentition and allows a specifically adjustable combination of translucency, brightness and opalescence. The framework (Zenostar T) is an ideal base for the ceramic veneer. The defined cut-back enables the framework to be veneered efficiently. The reduced tooth shape allows the veneering ceramic to be applied in an even thickness. This ensures that the layered ceramic is heated uniformly during firing. For the fabrication of the prosthetic gingiva, we chose IPS e.max Ceram Gingiva materials with which we achieved a gingival area with a life-like appearance. The materials were applied and fired in a similar manner to the dentin and enamel materials.

Liner bake

First, the ZirLiner bake was carried out using the IPS e.max Ceram ZirLiner, a material with multiple functions. On the one hand, the ZirLiner creates a strong bond between the veneer and the framework. On the other hand, it gives the restoration depth of shade and fluorescence. We do not recommend omitting the ZirLiner as this can increase the risk of cracks and delamination. Before the ZirLiner is applied, the framework must be free from dust and dirt. Contamination must be avoided.

The IPS e.max Ceram Liner should cover the framework completely; we recommend applying the material in uneven layers. After a short drying time it can be fired (Fig. 6). The furnace settings have to be modified.

Start temp.	Drying time	Temp. increase	End temp.
403 °C	8 min	25 °C/min	960 °C
Holding time		**Vacuum**	
1 min		450 °C – 959 °C	

Wash bake

Due to the low thermal conductivity of zirconium oxide, the wash bake is indispensable. The veneering ceramic sinters directly onto the framework surface, and a homogeneous bond

Fig. 7: Preparing for the wash bake. Both the gingiva and the tooth areas were covered with the relevant materials.

Fig. 8: Selection of the required dentin materials (IPS e.max Ceram)

Fig. 9: The framework prepared for the first build-up layer

to the fired ZirLiner is achieved. First a wash bake was carried out in the pink esthetic zone. The restoration was placed onto a firing tray and then fired (Fig. 7). Then the IPS e.max Ceram Transpa Clear wash bake was carried out.

Recommended program for the wash bake:

Start temp.	Drying time	Temp. increase	End temp.
403 °C	8 min	25 °C/min	750 °C
Holding time		**Vacuum**	
1 min		450 °C – 749 °C	

Individual build-up of the white esthetics

The basic tooth shade for this restoration was A2. In order to achieve a unique and characteristic result, we individualized the ceramic materials and used other effects such as Deep Dentin, Impulse materials, intensives and opalescent materials (Fig. 8). We built up the ceramic on the prepared framework according to the layering diagram (Fig. 9). We used Build-up Liquids to mix the IPS e.max Ceram. We worked as closely as possible to the final tooth shape (Figs 10 and 11) and then fired the restoration.

The recommended firing program for the first dentin bake:

Start temp.	Drying time	Temp. increase	End temp.
403 °C	8 min	25 °C/min	750 °C
Holding time		**Vacuum**	
1 min		450 °C – 749 °C	

After firing, the bridge was trimmed and cleaned. This is ideally carried out in an ultrasound water bath or using a steam cleaner. The shape was then completed using ceramic and a second dentin bake was carried out. The firing parameter was based on the first dentin bake.

Individual build-up of the pink esthetics

There are 13 IPS e.max Ceram shades available for the prosthetic gingiva design. With this variety, it is possible to almost playfully recreate the gingiva. The shade guide belonging to the system aids in finding the correct shade. A natural reproduction is based on the anatomical prerequisites. For example, the keratinized gingiva is recreated with "light pink" materials as the blood circulation is naturally less in this area. On the other hand, the muco-gingival area is imitated using more

Figs 10a and b: The ceramic build-up was based on the specified layering diagram

Figs 11a and b: The framework before and after the first dentin bake

Figs 12a and b: The veneered prosthetic gingiva. A three dimensional design was fabricated and various different coloured materials were used.

Fig. 13: Situation after the first gingiva bake

Fig. 14: The restoration after the final polish by hand

Fig. 15: The screw-retained restoration on the implants

intensive materials (Fig. 12). With some skill a three dimensional gingiva design is produced and then the bridge is fired. Again, the firing parameters are adjusted and the temperature is lowered slightly. The presented case was also produced in this manner.

The recommended firing program for the first gingiva bake:

Start temp.	Drying time	Temp. increase	End temp.
403 °C	8 min	25 °C/min	745 °C
Holding time		**Vacuum**	
1 min		450 °C – 744 °C	

For the second gingiva bake, the shape was completed and the furnace temperature lowered again by 5 °C (Fig. 13). After this bake, the restoration had a distinct three dimensional shape and a very natural appearance. The teeth had a good depth of colour and a warm translucency.

Completion

Whilst finishing the restoration, full attention was paid to the texture and morphology. The harmonious exchange of raised and depressed areas gave rise to natural looking reflections. In addition to the edges and curves, the effect of finely detailed structures is not to be underestimated (microstructure). We therefore intentionally introduced slight irregularities in order to produce a certain liveliness. Finally, the restoration was finished with a rubber polisher and then glaze fired (without glaze material). We achieved the required gloss level by manual polishing (Figs 14 and 15).

Direct link to the tablet version:

Scan the QR code with the tablet
or enter the following link:
http://www.ivoclarvivadent.com/reflect

The recommended firing program for the glaze bake:

Start temp.	Drying time	Temp. increase	End temp.
403 °C	6 min	60 °C/min	725 °C
Holding time		**Vacuum**	
1 min		450 °C – 749 °C	

Conclusion

In dental technology, manual skills and optimal materials are essential, but also a profound knowledge of materials science and material specific characteristics are of fundamental value. In particular, when dealing with a complex restoration on a zirconium oxide framework, correct handling is a major criterion for success. In the case presented, the framework (Zenostar T) and the ceramic veneer (IPS e.max Ceram) successfully harmonized with one another so that a vibrant play of colours was created. Due to accurately selected firing parameters no delamination or late cracks are to be expected.

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Esthetics in the anterior maxilla

A team-oriented approach

Sofie Velghe, Kortrijk, and Aryan Eghbali, Brussels/Belgium

Multidisciplinary collaboration plays a significant part in achieving predictable treatment results. This article raises awareness of the importance of accurate case analysis and preoperative planning.

This case report describes the reconstruction of two lost central incisors in the anterior maxilla. After tooth 11 was extracted, measures for preserving the alveolar ridge were performed. After eight weeks, an implant was placed and a screw-retained temporary bridge was fabricated. Prior to inserting the temporary bridge, tooth 21 was extracted and immediately replaced by an implant.

Introduction

The impending loss of a tooth in the esthetic zone can be a distressing experience for the patient [1]. As the success rates and predictability of dental implants have improved over the years, implant-based treatments are gaining in popularity [2, 3]. Osseointegration is no longer the only criterion for successful implant therapy; the esthetic outcome of the implant reconstruction is also important.

An esthetic implant restoration may be defined as a restoration that is in harmony with the perioral facial structures.

Fig. 1: Disharmonious transition between the gingival margin and the PFM crown. The "collapse" of the emergence profile at site 11 is clearly visible.

The esthetic peri-implant tissues should be in harmony with the healthy surrounding dentition in terms of height, volume, shade and contours. The restoration should imitate the life-like appearance of the missing tooth in terms of shade, shape, structure and size as well as the optical properties [4]. In a multidisciplinary team approach, several treatment modalities such as minimal invasive methods, ridge preservation protocols, connective tissue grafting, provisionalization and plastic-esthetic periodontal surgery should be considered. In addition, a thorough analysis, e.g. with the Digital Smile Design, is crucial [5].

Case report

A few years ago, both central incisors of this young male patient were restored with metal-ceramic crowns. From today's perspective, the restoration must be categorized as an esthetic failure (Fig. 1). Both teeth showed significant amounts of gingival recession, visible crown margins and a loss of harmony between the gingival architecture and the restoration. The treatment plan was to replace the two central incisors by two implants with screw-retained monolithic lithium disilicate crowns. To create a harmonious esthetic appearance, the two lateral incisors would be built up with composite material.

Surgical phase

The initial assessment resulted in a treatment plan where both incisors were to be replaced by implants (NobelActive, Nobel Biocare). In order to maintain the central papilla between the incisors, a gradual extraction of the two teeth was performed, starting with tooth 11. A few weeks later, tooth 21 was extracted, followed by immediate implant placement. A temporary bridge with an extension as tooth 21 was fabricated in order to contour the soft tissue. Figures 2 to 5 show the surgical phase aimed at preserving the soft tissues.

Prosthetic phase

Preserving the soft tissue plays an important part in the success of the treatment. Transmitting these data to the dental technician presents a challenge [6]. To replicate the soft tissue

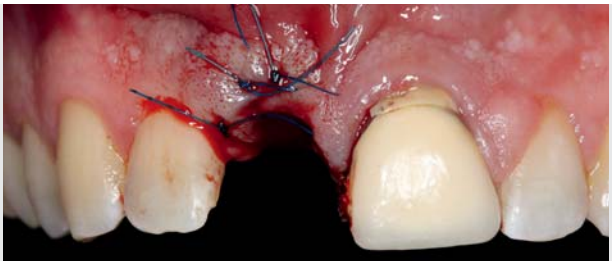


Fig. 2: Eight weeks after extraction of tooth 11: convex contour of the alveolar ridge and preservation of the soft tissue

Fig. 3: After insertion of the implant at site 11. Ten weeks later, an impression was taken and a temporary bridge with an extension for site 21 was fabricated.

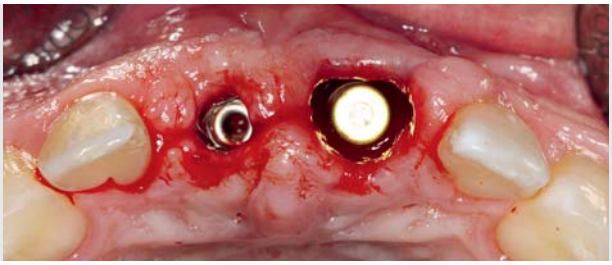


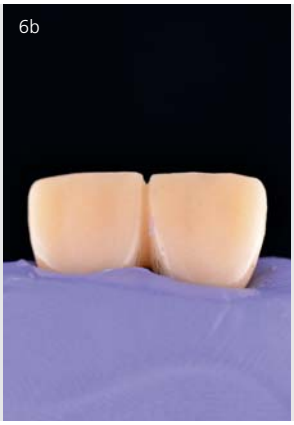
Fig. 4: The second implant was placed immediately after extraction of tooth 21.

Fig. 5: The temporary bridge with the extension for site 21 was screwed to implant 11. After two months, the buccal contour at the site of 21 was corrected with a connective tissue graft.

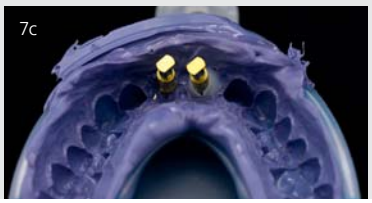
architecture, a standard impression coping on implant 11 was individualized. Then, an impression was taken of the implants at site 11 and 21 using an individualized and standard impression coping respectively (Figs 6a and b). The resulting plaster model was modified by grinding at site 21. Then, a silicone impression material was used to record the emergence profile of pontic 21 of the temporary bridge (Figs 7a to c). This information was transferred to a standard impression coping, which resulted in an individualized impression at implant site 21 (Figs 8a and b).

At the next step, the situation was assessed using a DSD analysis (Figs 9a and b). The evaluation revealed a disproportionate distribution of volume between the central and lateral incisors. The lateral incisors were too narrow compared with the wide and square shape of the central incisors. In order to enhance the harmony, the volume should be distributed across the four incisors. New screw-retained temporaries were fabricated. Prior to this, a wax model was adapted and tested intra-orally to visualize the outcome.

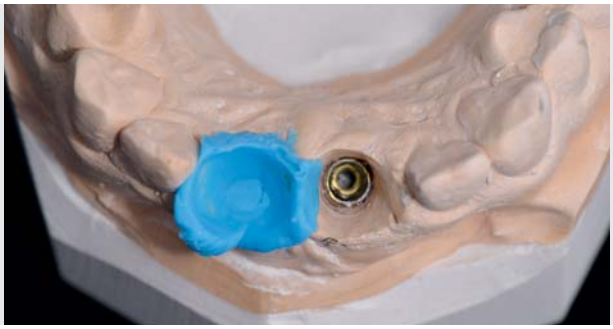
A silicone key was created to first build up the lateral incisors with a temporary composite material [7]. With the temporary crowns and the composite mock-up of the lateral incisors, the shape of the wax-up could be transferred. This "blueprint" served to evaluate the "new smile" intra-orally prior to fabricating the permanent restorations. Shade selection was performed with the help of cross-polarized light. Unwanted reflections were effectively eliminated with a polar eye filter. To fabricate the final prosthetic restorations, the temporaries



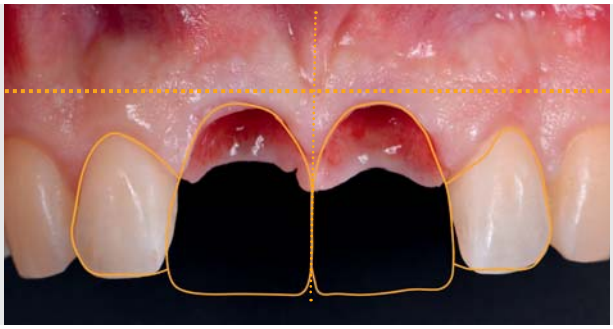
Figs 6a and b: Fabrication of the individualized impression coping for the implant at site 11. The emergence profile of the temporary should be transferred to the final restoration. This procedure prevents the emergence profile from "collapsing" during impression taking.

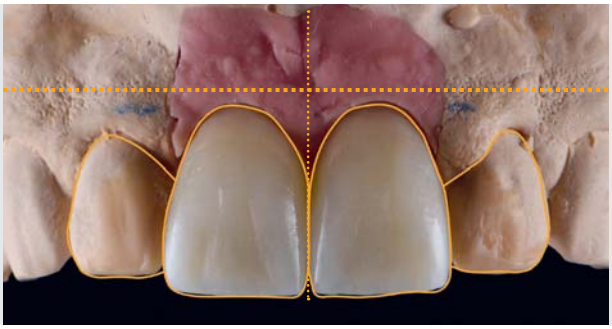


Figs 7a to c: Impressions of the implants at site 11 and 21 with an individualized and standard impression coping and the model fabricated on the basis of these impressions



Figs 8a and b: Implant model. The basal region at site 21 was modified by grinding and the emergence profile of the pontic at site 21 of the temporary bridge was recorded using silicone.





Figs 9a and b: Analysis and planning using the Digital Smile Design method. Compared with the lateral incisors, the central incisors were too wide. The entire volume should be distributed across the four anterior teeth.

Fig. 10: Individual stages in the intraoral fabrication of the composite build-ups on the lateral incisors

Figs 11a and b: Result: Shade, shape and size of the anterior teeth create a harmonious appearance.

were duplicated and 1:1 copies were made using IPS e.max® Press (monolithic lithium disilicate).

Screw-retained IPS e.max Press crowns were placed on the implants and the screw openings were filled with Teflon (PTFE) and covered with composite. Once the restorations were placed, the lateral incisors were built up with IPS Empress® Direct composite. A palatal matrix made of silicone putty was used as an auxiliary. The shade match of the chosen composite and the IPS e.max ceramic was deemed ideal. A rubber dam was used for isolation (OptraDam® Plus).

A composite stratification technique was used to build up the incisors (Fig. 10). The enamel was slightly roughened, etched (37% phosphoric acid, 15 seconds, total etch) and then coated with a light-curing adhesive (Adhese® Universal). The adhesive was scrubbed into the bonding surface and then light-cured (Bluephase® Style). First, the palatal "enamel shell" was build up using IPS Empress Direct Enamel in shade A2 and a palatal silicone key created from the mock-up. Dentin A3 was used for the dentin core and the mamelons. A natural looking result was achieved due to the translucent incisal effect created between the mamelons with the help of IPS Empress Direct Trans Opal. After that, the build-up was covered with a layer of IPS Empress Direct Enamel A2. The morphological structures were contoured and accentuated using fine diamond grinders, Arkansas stones, green grinders and polishing discs. Silicone polishers and diamond paste were used for polishing.

The outcome was a harmonious appearance of the anterior maxillary front in terms of shape, shade and size (Figs 11a and b).

Discussion

Although the presence of the papilla may not be the key issue following single implant treatment [8-10], preserving the papilla between two implants remains a challenge. The decision in this case was to extract the two teeth in stages and use temporary restorations to preserve the papilla. In addition, connective tissue grafts carried out at various points in time ensured ideal soft tissue contours. Although only a few references regarding the stability of connective tissue grafts can be found in the literature, recent studies have shown promising results [11].

Since the aim is to establish a harmonious balance between the teeth and ensure appropriate white esthetics, preoperative planning and a detailed case analysis are advisable [12]. It is also important to think carefully about which materials to use. In contrast to zirconium oxide and titanium, monolithic lithium disilicate restorations do not stimulate a subgingival attachment to the soft tissue [13]. Therefore, a hybrid abutment consisting of zirconium oxide or titanium could present an alternative.

Conclusion

A multidisciplinary team approach is mandatory to achieve a predictable treatment outcome. Besides that, a detailed analysis and preoperative planning procedure play a crucial part. Here, photo- and video-based evaluations present powerful instruments.

All prosthetic procedures were conducted by Sofie Velghe, a prosthodontist, and all restorations were fabricated by Stephan van der Made, a dental technician.

The authors thank the dental lab Kwalident and especially Stephan van der Made for their contribution.

Literature available from the editors on request

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See, recognize, realize

Visual shade analysis and its realization into a ceramic crown

Bastian Wagner, Munich/Germany

The wide variety of ceramic materials available today, allows the dental technician to reproduce the natural, dynamic light qualities present in natural dentition. Recognizing and realizing these visual characteristics, however, is a challenge which can only be mastered with a great deal of patience and knowledge.

Each individual patient case requires the full attention of all involved – patient, dentist, dental technician – to the finer details in this complex piece of work. It is the dental technician's job to produce a durable prosthetic restoration, which with its functional, biological and esthetic characteristics, is adapted to suit the individual requirements and specifications of the patient.

The advancement in technologies and materials within the last few years has dramatically changed the work of dental technicians. We are, however, still often faced with a huge challenge: to recreate nature's perfection and provide oral harmony. In particular, consistency and discipline are needed to fabricate anterior teeth. In order to produce an esthetic restoration, the dental technician must recognize the correlation between the tooth shape, surface structure and function and the effects of phonetics and colour. These factors form the foundation.

With a passion for the work involved and the necessary sensitivity and specialized knowledge, a lifelike appearance can be successfully imitated. At times this can be a laborious task and require a great deal of patience and sometimes it takes quite a few attempts to achieve the desired results. In order to realize a harmonious and esthetic smile in the end result, good communication between the patient and dental technician is essential. The patient's expectations must be clearly understood by all parties and their wishes transposed as a team. This article concentrates on shade selection and shade reproduction using the veneering ceramic IPS e.max® Ceram. The fabrication of an anterior tooth is shown on the basis of a patient case.

The visual properties of natural teeth

Three shade characteristics must be taken into account when determining the shade: the colour (Hue), the brightness (Value) and the colour intensity (Chroma). The colour itself is the most obvious part of a shade. The brightness is a definition of how light or dark a colour is. The colour intensity describes the purity of a colour. The highest attention should be paid to the brightness. If the value of a restoration is not ideally matched to the rest of the dentition, then even the slightest deviation can be detected within normal speaking distance by the person standing opposite. [2].

In general, it is very important to understand the three visual properties and use the chosen ceramic system to adapt to each situation individually.

The principles of shade selection

For shade selection a shade guide is used, which presents the following colour tones:

A = orange
B = yellow/orange
C = grey/orange
D = brown/orange

The shade should be selected at the start of the restorative treatment so that it is not affected by a dehydrated natural tooth structure. In order to select the hue, value and chroma, individually fabricated shade samples in the relevant ceramic assortment can be useful (Fig. 1). The ceramic materials are designed in such a way that the complex shades and characteristics of natural teeth can be better distinguished. The colour of the gingiva or other surrounding influences can affect the shade selection. For example, the background colour during shade selection can change the perception of the colour intensity and the colour tone. In order to avoid any misinterpretation it is advisable to cover the dark oral cavity with a grey card. Another method is to use a gingiva coloured holder (Gumy, Shofu, Germany) for each individual shade sample in order to provide simultaneous and successive contrast effects. The samples are surrounded by a colour which imitates their natural environment. The Gumy gingival mask is available in

Fig. 1:
Individual shade samples
for the ceramic range
IPS e.max Ceram

four different colours. When a shade is selected, the sample is then placed into the Gumy so that it can be checked with the gingiva. For basic shade determination it is advisable to take a photo of three different shade samples on one photo. This provides a comparison. One sample should represent the brightness of the tooth to be prepared; the second should have a lower value and the third a slightly higher value. Furthermore, during the preoperative shade determination, important information on the selection of a suitable material should also be considered.

Photographic documentation of the shade selection

In an addition to the shade selection, photo documentation is essential. A photographic shade comparison of the natural tooth colour and the corresponding shade tabs provides further details. In general, digital photography is a unique communication tool for the entire treatment team and it should be firmly established within the treatment process [1]. When taking photographs, the following procedure must be observed. The shade sample and the natural tooth must both be parallel to the sensor level on the camera and receive the same amount of light exposure as the camera flash. The shade information in the photograph and the anatomical and morphological characterization can then be analyzed on the screen. In order to avoid falsified information on the screen, it should be calibrated perfectly. If a grey card is used whilst photographing, differing camera values can be corrected using white balance with the image-editing program (e.g. Adobe Photoshop Lightroom). Information is not lost or distorted. When the photos are converted in the image-editing program into black and white pictures, the surface texture and difference in brightness is clearly visible. To better identify internal characterization, the contrast control can be adjusted to "maximum" and the highlight function to "minimum". This will show all details clearly. The collected information is converted into a shade diagram, which is synchronized with the ceramic material to be used, and a layering concept is created. The following case shows one possible procedure for realizing the determined tooth shade.

Patient case

This patient case with the reconstruction of tooth 11 shows clearly how the determined shade can be reproduced. The preoperative shade analysis shows that the adjacent tooth 21 has a very high degree of brightness in the cervical area and in the body (Figs 2 and 3). The natural tooth exhibited opalescent/transparent areas on the ridges and in the incisal region. The mamelon structure had a high value and a slightly yellowish chroma (Figs 4 and 5). The basic shade selected was BL 3. Various methods can be used to increase the brightness of the IPS e.max Ceram ceramic. In this case, due to the high degree of value, the brightness of the dentin B1 ceramic material was

Fig. 2: Reconstruction of tooth 11. Shade determination at the beginning

Fig. 3: Shade determination with gingiva coloured holder for the shade samples

Fig. 4: Shade determination of the internal structures

Fig. 5: Selection of the individual opal materials using self-fabricated shade samples

increased with the highly fluorescent MM light ceramic material from the IPS e.max range. The framework material used was an MO1 press ingot (Fig. 6). The structure was lightly covered in a wash bake with MM light and then fired (Fig. 7). During the first dentin bake, the framework was evenly covered with dentin B1 and MM light. The area towards the ridge which had a high degree of value was imitated using Deep Dentin B1 and MM light to a ratio of 4:1 (Fig. 8). The tooth shape was then completed using Dentin BL 3 (Fig. 9). Cutting back the incisal area and the edges made space for the Effect materials. Before the actual build-up, in order to create the mamelon structure, the material MM light was mixed with Essence Lemon and White until the ideal mixing ratio had been found and then a firing sample was fabricated. The exactly mixed ratio was then applied to the incisal plate (Fig. 10) and the edges were built up with OE 1. The incisal plateau was completed by alternately layering OE 2 and OE 3 (Fig. 11). Finally, the halo-effect was imitated from the incisal edge to the proximal area and the crown was then fired (Fig. 12). The second bake included slight shape corrections. To achieve a natural appearance the ceramic surface was given structure and then fixed with a glaze bake (Figs 13 to 15).

Fig. 6: The crown framework IPS e.max Press (MO1 ingot) before the wash bake

Fig. 7: Wash bake and characterisation with MM light before firing

Fig. 8: The crown framework was built up with Dentin B1 and MM light and Deep Dentin and MM light (ratio 4:1) was built-up towards the edges

Fig. 9: Completion of the internal structure with Dentin BL 3

Fig. 10: Application of the mamelon structure with a mixture of MM light and Essence materials

Fig. 11: Completion of the incisal plate with Opal materials

Fig. 12: Results after the first bake

Fig. 13: Checking the surface structure

Fig. 14: The finished piece of work after the glaze firing

Fig. 15: The finished restoration of tooth 11 in situ

Conclusion

The diverse spectrum of a modern ceramic range gives the technician the ability to reproduce a variety of dynamic light features. Recognizing and realizing the tooth shade is and always will be a huge challenge. This is why the intensive study of chromatics and of your own ceramic assortment is essential. Even though the material prerequisites for reproducing lifelike restorations are available, each dental technician is responsible for developing their own skills and capabilities. The challenge of recreating a shade will always be unique for each different patient case.

In autumn 2015, Ivoclar Vivadent introduced the IPS e.max Ceram Power Dentin and Incisal layering ceramics which feature a high brightness value. These materials are ideal for use on less reflective translucent substructures. In cases such as the one presented in this article, in which a high degree of brightness is required, the Power materials can also be used on opaque frameworks to realize the desired results with little effort.

Literature available from the editors on request

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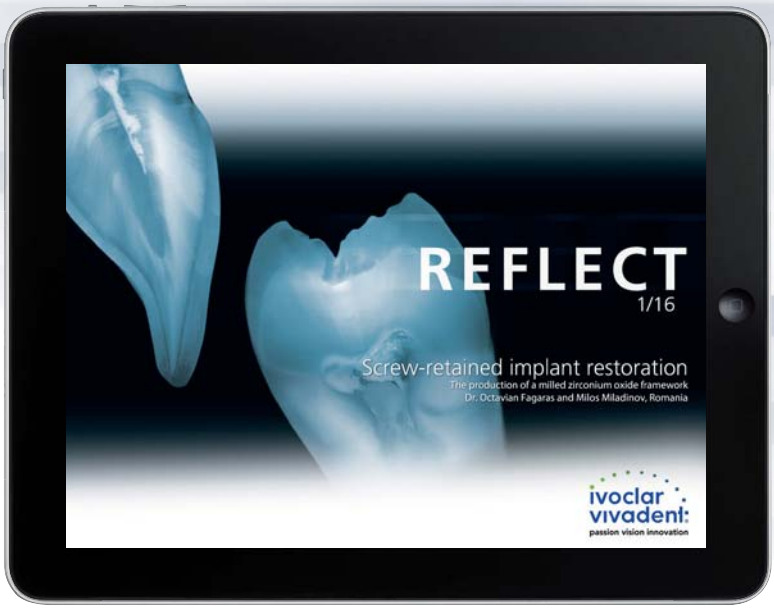

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