# REFLECT

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## New developments in bulk filling technology

Treatment of the second upper premolar of a 32-year-old female patient

## A perfect synergy of technologies

CAD/CAM materials in combination with a new luting composite

## Natural-looking imitation of pink esthetics

Completing a denture base using the IvoBase System

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## Dear Readers

Dentistry is no longer just a case of filling and taking out teeth. Today's patients turn to dentists and demand esthetic dentistry as a way of improving their appearance. Restorative dental materials fulfil an important role in the way dentistry is delivered today. The level of esthetic requirements in clinical practice has increased over the past decade and this has made it necessary for dentists to explore this field in order to satisfy the growing demand.

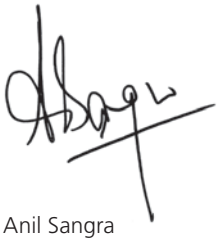
The strong interest in our various new products at the IDS 2015 confirmed once more that we are on the right track with our strategy of innovation and specialization. However, we do not only develop new products, but also support dentists and dental technicians with their further education so that they can better fulfil their patients' needs.

Time flies, in another couple of months I will have been with Ivoclar Vivadent for three years. I have to admit that I am so fortunate to be surrounded by such a warm, helpful and supportive family all the time.

This issue of Reflect demonstrates once again how dentists/labs around the world continue to achieve astonishing results to create happy patients utilising Ivoclar Vivadent technology.

Happy reading!

Yours sincerely



Anil Sangra
Managing Director
Ivoclar Vivadent Marketing Pvt. Ltd, India

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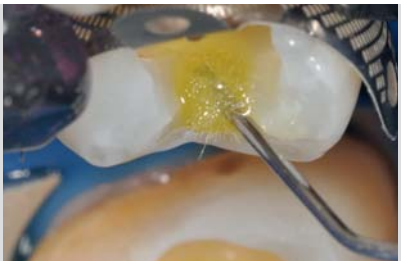

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# New developments in bulk filling technology

Treatment of the second upper premolar of a 32-year-old female patient
*Dr Eduardo Mahn, Santiago/Chile*

## Tetric EvoFlow Bulk Fill: A combination of Aessencio technology, light initiator Ivocerin and shrinkage stress reliever for applications in one increment layer of up to 4 millimetres

The success of the Tetric Evo line of products from Ivoclar Vivadent is widely acknowledged. For more than a decade, the universal composite Tetric EvoCeram® has been successfully used in direct restorative procedures. In 2011, the bulk-fill variant Tetric EvoCeram Bulk Fill was launched, whose patented light initiator Ivocerin® is considered to be a milestone. The consistent further development of the Tetric Evo products has led to yet another innovation: the flowable version of Tetric EvoFlow® Bulk Fill. In the case presented, the perfect interplay between the two products is highlighted. They have good chances of becoming a winning team.

### Development stages

A lot has been said about the paradigm shift in direct restorative dentistry. When most of us started or even finished dental school, mastering the incremental layering of composite resin was not only mandatory to get our degree as dentists, but obviously also essential to obtaining better long-term results. The concept was based on the C factor (the relationship between the composite area bonded to the tooth and the non-bonded area), which was clearly reduced when composite was placed in several steps using a horizontal or, even better, an oblique layering technique. Over time, we realized that the C factor was not as decisive as we originally thought. Class I restorations, which had the worst C factor, were performing best,

Fig. 1: Pre-operative situation

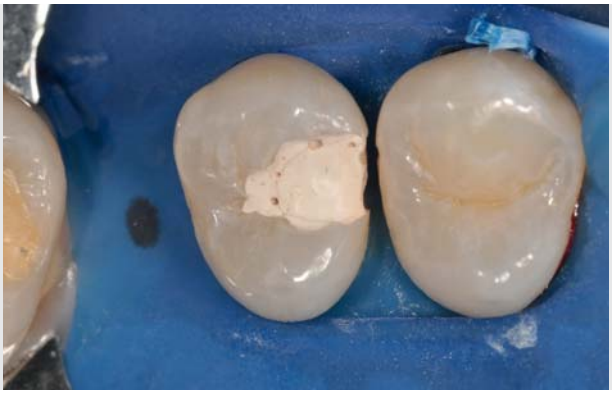


Fig. 2: Situation after rubber dam placement (OptraDam)

Fig. 3: Placement of the V4 matrix and wedge system (Triodent)

Fig. 4: After etching the enamel with phosphoric acid, Adhese Universal was applied directly with the VivaPen.

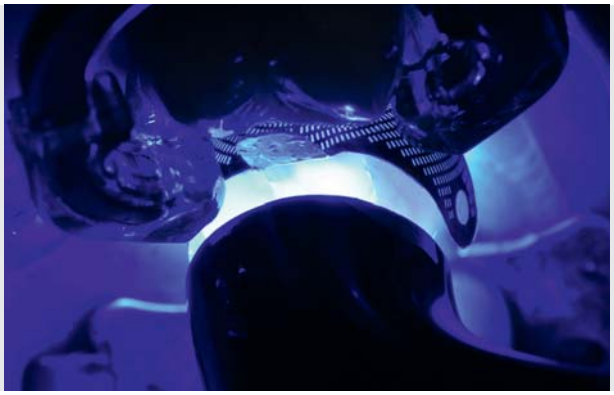


Fig. 5: After air-blowing, the adhesive layer was cured.

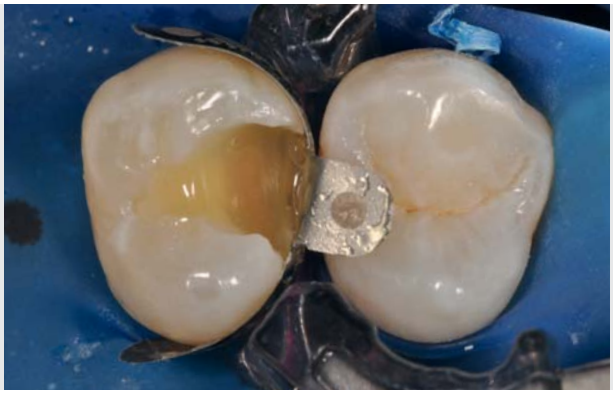
while Class V restorations with a much better C factor were performing worse than Class II restorations or even worse than Class I restorations. These findings, together with new improvements in composite technology, such as the addition of shrinkage stress relievers and new initiators, gave a good enough reason to start bulk filling cavities. Nevertheless, logical thinking told us that the thinner the layer, the less shrinkage stress would be present, since the higher the volume of composite, the more volumetric shrinkage would occur. This is the reason why manufacturers started to combine the benefits of the two groups of bulk-fill composites, flowable and sculptable ones, with promising results. Only one main drawback remained, that is, the high translucency of the materials, which was necessary to achieve a higher depth of cure. Since this year, this drawback has been overcome thanks to the newly developed Aessencio technology from Ivoclar Vivadent, which is used in Tetric EvoFlow Bulk Fill. During the polymerization process the translucency of this composite resin decreases and finally comes very close to that of dentin. This technology, in combination with the highly reactive, patented light initiator Ivocerin and a patented shrinkage stress reliever, allows the composite to be placed in layers of up to 4 mm in depth.

## New composite available in two versions

Both the sculptable version, Tetric EvoCeram Bulk Fill, and the flowable version, Tetric EvoFlow Bulk Fill, are a further development of the 10-year clinically proven Tetric EvoCeram. Tetric EvoCeram Bulk Fill and Tetric EvoFlow Bulk Fill contain the highly reactive light initiator Ivocerin, which complements the standard photo-initiator system. Tetric EvoFlow Bulk Fill is used as a volume replacement material in the restoration of Class I and Class II cavities. It needs to be covered with a layer of load-bearing composite, such as the mouldable composite Tetric EvoCeram Bulk Fill. For deciduous teeth, no capping layer is needed.

## Case report

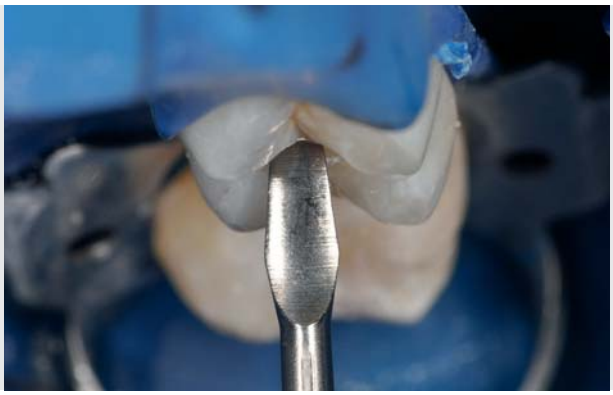
A 32-year-old female patient came to our practice with a temporary filling. Figure 1 shows the pre-operative situation with the absence of the contact point. Figure 2 shows the situation after rubber dam placement (OptraDam®). After the temporary filling had been removed and the remaining caries had been excavated, a sectional matrix was placed (Fig. 3) and secured with a translucent wedge and a ring (V4 system, Triodent). This matrix system enables the clinician to achieve a tight seal at the margin, since the wedge is just for sealing the cervical margin and not for separating the teeth. The necessary separation to compensate for the thickness of the matrix is achieved by the pressure of the translucent ring. The adhesive (Adhese® Universal) was applied after etching the enamel only with phosphoric acid for 30 seconds (Fig. 4). The adhesive was applied for 20 seconds with an active rubbing motion. This procedure combines the best of two worlds, since by etching the

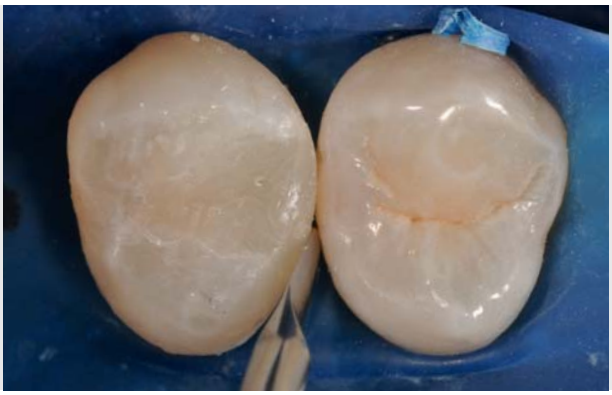


Figs 6a and 6b: Application of Tetric EvoFlow Bulk Fill. The dramatic change in translucency due to the Aessencio technology after light-curing is clearly visible.

Fig. 7: Application of Tetric EvoCeram Bulk Fill

Fig. 8: Situation after sculpting, before final curing





Figs 9a and 9b: Finishing with sonic tips (Komet)

enamel, a good etching pattern is created which allows for a better interaction with the adhesive. The smear layer on the dentin was left intact, as a self-etching protocol was followed in this area. The solvent was evaporated and the adhesive cured with an LED curing light (Bluephase® Style) (Fig. 5). Afterwards, Tetric EvoFlow Bulk Fill was applied (Figs 6a and 6b).

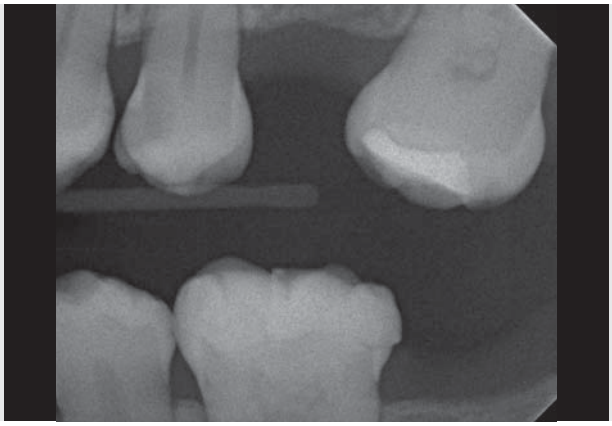
Note the difference in translucency before and after curing!

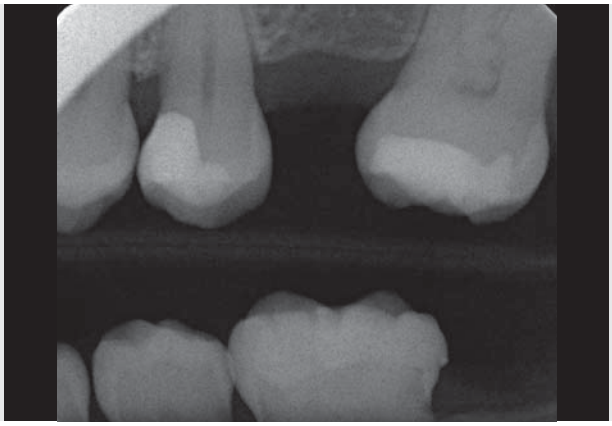
This is made possible thanks to the Aessencio technology. Figure 7 shows the application of Tetric EvoCeram Bulk Fill as the last layer.

Before curing, the anatomy was sculpted as precisely as possible to avoid unnecessary wastage of material (Fig. 8). Next, the finishing process was started with sonic instruments (Komet) (Figs 9a and 9b). The vibration of these instruments allows the clinician to precisely remove minimal excess without damaging the tooth structure. Then polishing was performed with OptraPol® and a fluoride varnish was applied (Fluor Protector S) (Fig. 10). Figures 11a and 11b show the incisal and frontal views of the restoration one week after placement. Outstanding es-

Fig. 10: After polishing with OptraPol, Fluor Protector S was applied.

Figs 11a and 11b: At the recall after one week: perfect esthetic and functional integration





Figs 12a and 12b: X-ray control: Note the outstanding radiopacity of both materials.

thetic and functional integration was achieved. Figures 12a and 12b show the x-ray before and after the placement of the filling, where a more than dentin-like radiopacity of both materials, Tetric EvoFlow Bulk Fill and Tetric EvoCeram Bulk Fill, is noticeable.

## Conclusion

The flowable Tetric EvoFlow Bulk Fill, with its dentin-like translucency, is the ideal complement to Tetric EvoCeram Bulk Fill, which convinces with its enamel-like translucency. Both composites are available in the universal shades $^{IV}$A, $^{IV}$B and $^{IV}$W, thereby combining esthetics and efficiency, without neglecting the shrinkage stress.

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# A perfect synergy of technologies

CAD/CAM materials in combination with a new luting composite

*Carlo Monaco, DDS, MSc, PhD; Prof. Dr Giovanni Zucchelli, PhD, DDS, Bologna, and Luigi De Stefano, DT, Scafati/Italy*

## A platform that allows esthetic results to be achieved with astonishing ease can be created by combining CAD/CAM technology with a high-strength ceramic and a modern luting material.

State-of-the-art technologies and materials provide a fast route to achieving excellent results. With careful clinical planning, the chairside part of the treatment can often be completed in a single appointment. Intraoral digital impressioning circumnavigates the risk of deformed impression materials and allows preparations to be visualized in a 3D format. Three-dimensional visualization helps patients form a clear idea of what their treatment can achieve and increases the likelihood for obtaining their approval. These advantages are augmented by the favourable mechanical properties of modern ceramic materials such as lithium disilicate glass-ceramics ($LS_2$). In a nutshell, the benefits of CAD/CAM-based manufacturing include reduced treatment times, enhanced accuracy of impressions and precise visualization of the treatment outcome. The following case report describes the clinical steps required in the fabrication of anterior single-tooth crowns to achieve functionally and esthetically first-class results.

### Preoperative assessment

A female patient presented with anterior metal-ceramic restorations, wishing for an improvement of her esthetic appearance (Fig. 1). A radiographic examination was carried out followed by an intraoral photographic series. Then, the esthetic parameters were evaluated. Using the conceptual treatment planning tool Digital Smile Design (DSD, Dr C. Coachman), the desired changes were visualized on the computer and discussed with the patient. Visualization is essential in an esthetically motivated treatment that requires preparation of the tooth structure because it affords the opportunity to familiarize the patient with the most salient changes in a straightforward fashion.

Fig. 1: Female patient with metal-ceramic restorations, wishing for an improvement of her esthetic appearance.

Fig. 2: Mock-up fabricated on the basis of the wax-up and fitted to the patient's teeth.

Fig. 3: Suboptimal abutments after removal of the existing restorations

Fig. 4: Abutments after having been built up with composite. Situation at the end of the first temporization step

Fig. 5: Second temporary stage after surgical crown lengthening

After the patient had approved of the treatment, a conventional intraoral impression (polyvinyl siloxane) was taken and a diagnostic wax-up fabricated. The gum line was not altered at this stage. The diagnostic wax-up was key in helping the patient fathom the prospective three-dimensional volumetric change in her anterior dentition and fabricating the temporary restoration. Among other things, the patient's main concerns were to have the excessive length of her anterior teeth ameliorated to harmonize with the surrounding dentition and to have the severe palatal curvature mitigated.

## Planning and temporization

The information gained from the DSD procedure and the try-in of the mock-up formed the basis for the final treatment planning. The mock-up model conveyed a precise impression of the morphological changes to be applied to the teeth. At the try-in, the canines were found to be too long in relation to the new appearance of the central and lateral incisors (Fig. 2). To redress this situation, the patient was given the option to have her canines reduced by approx. 1 mm following the insertion of the temporary restoration. Furthermore, the patient was informed of the need for surgical intervention to adapt the course of her gum line. Treatments necessitating a reduction of healthy tooth structure and/or a change of the gingival profile require the use of visualization software, such as the Digital Smile Design program, because such changes cannot be made visible with models or mock-ups.

After the existing restorations were removed with a tungsten carbide bur (Fig. 3), the resulting abutments were in a suboptimal condition and tooth 22 was damaged by a carious lesion. It was therefore necessary to build up the abutments using composite material and an adhesive before the temporary PMMA restorations (polymethyl methacrylate) could be placed. The primary objective was to avoid a further reduction of tooth structure. After completion of the conservative treatment, the built-up teeth were again slightly reduced to create space in the interproximal area with the aim to encourage the papillae to grow into the interdental spaces between the temporary restorations (Fig. 4).

## Surgical intervention

Surgical crown lengthening was performed to attain a harmonious gum line. After the periodontal surgical soft tissue procedure, the bucco-lingual bone was reduced using a diamond-coated drill and hand chisel with the aim to expose 5 mm of tooth structure above the alveolar bone crest. After the surgical intervention, the exposed root surfaces were smoothed up to the bone crest with the help of curettes, followed by the preparation of the abutment teeth. Here, the aim was to modify the natural emergence profile of the teeth as they emerge from the alveolar ridge and, as a result, to limit the coronal growth of the soft tissue portions in the buccal and palatal areas. Finally, the soft tissue flaps were secured over the buccal and palatal sides of the alveolar bone using simple vertical mattress sutures (PGA 6/0) and anchored to the periosteum on the buccal side. After the surgery, the temporary restorations were inserted using calcium hydroxide cement. This intervention meant that the patient was not able to clean her teeth in the areas affected. Instead, she was

instructed to rinse with 0.12% chlorhexidine solution for one minute three times a day.

### Temporization

At the following appointment, the sutures were removed and a precision impression - without placing a retraction cord - was taken. This impression was used to create a second "series" of temporary restorations amenable to relining. Three weeks after the surgery, the final preparation of the abutments was performed. The gum line was used as a reference to provide orientation in the cervical region. Early temporization was advantageous to soft-tissue conditioning. With this measure, a potential soft-tissue rebound was easier to monitor and the desired esthetic outcome could be achieved in a targeted fashion. Over the following five to six months, the temporaries were additionally modified to allow the interdental papillae to grow into an appropriate shape.

### Intraoral data capturing

Six months after the surgery, the soft tissue had developed into an ideal shape (Fig. 5). Time had now come to begin with the final prosthetic stage. Only one appointment was planned for this stage. As the patient was satisfied with the morphological shape and function of the temporary restorations, the PMMA restorations were utilized as prototypes for the final crowns. Two digital impressions were required. At the first step, a digital record of the temporary restoration was created and subsequently used as a "biogeneric" model. At the second step, the abutment teeth were digitally recorded after a retraction cord had been placed. Both the temporary restorations and abutment teeth were coated with a dusting of scanning powder to facilitate optical data capturing (Figs 6 to 8). After intraoral scanning (CEREC® Bluecam, Sirona Dental Systems GmbH, Germany), the data were imported into the CAD software (CEREC Software V. 4.2) and integrated into the design of the restorations. The parameters concerning the space for the luting composite and adhesive were set to 30 and 20 µm respectively and the minimum incisal ceramic was set to 1,5 mm. Additionally, digital records of the opposing jaw and bite registration were also taken.

### Material

All-ceramic restorations should demonstrate natural optical properties and offer a lifelike surface texture.

> Many manufactures have developed materials that can hardly be distinguished from their natural counterpart, i.e. the tooth.

Simultaneously with the advancement of CAD/CAM technology, the manufacture of CAD/CAM blanks has been consistently improved. Esthetic results that look intriguingly similar to the natural dentition can now be easily achieved due to the combination of the "enamel-like" optical properties of the IPS e.max® CAD HT blocks (high translucency) and the staining technique - no individual layering is required. Lithium disilicate glass-ceramic blocks (IPS e.max CAD HT C14/A2) were the chosen material for the case described here. The blanks were processed in the CEREC milling unit (Sirona) using a Step Bur 12 and a Cylinder Pointed Bur 12S (Fig. 9).

### Crown seating

After crystallization firing, the restorations were fitted on the abutment teeth and their accuracy of fit was evaluated. Minor shape adjustments were performed and the occlusal and proximal contacts adjusted (Fig. 10). Finally, customized effects were applied to the crowns using the staining tech-

Fig. 6: Intraoral digital registration of the temporary restorations

Fig. 7: The temporary restoration was used as a "biogeneric" model.

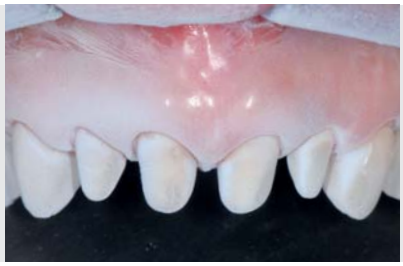

Fig. 8: Preparing the digital scan of the abutment teeth

Fig. 9: Crowns were designed and then milled from lithium disilicate blocks (IPS e.max CAD HT C14/A2).

Fig. 10: Try-in of the milled crowns and adjustment of proximal contacts

Fig. 11: Customization using the staining technique

Fig. 12: Selecting a suitable shade of the luting composite (Variolink Esthetic DC) using glycerine-based water-soluble try-in pastes

Fig. 13: Final seating of the individual crowns. Air blocker (Liquid Strip) was applied to prevent the formation of an inhibition layer during light-curing.

Fig. 14: Permanently seated restoration. In only one treatment session, the final prosthetic restoration was completed and seated.

nique (IPS e.max Ceram Shades) (Fig. 11). The dual-curing luting composite Variolink® Esthetic DC was selected for placing the crowns. This material is available in several shades to allow an ideal esthetic integration. Water-soluble, glycerine-based try-in pastes provide valuable assistance in selecting the correct colour composite (Fig. 12). With these pastes, the shade effect of the all-ceramic restoration can be simulated before it is permanently cemented. The try-in pastes feature the same shade and translucency as the luting composite after it has been cured. The consistency of the try-in paste is similar to that of the luting composite. In the present case, each time the restoration was tried in with one of the coloured try-in pastes, the shade effect was measured using a colour measurement device (SpectroShade, MHT). With the five different shades Light+, Light, Neutral, Warm and Warm+, the translucency can be modified in varying degrees of percentage, ranging from brighter/whiter to darker/yellower and the darker shades can be used to change between the levels of opacity and translucency. With a translucency of approx. 10% and a relatively bright shade effect, the "Light" version was selected for the final cementation. The crowns were seated on the same day (Figs. 13 and 14).

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## Conclusion

In the case presented here, the combination of CAD/CAM technology, a lithium disilicate glass-ceramic and a colour-balanced luting composite enabled us to use a straightforward and efficient method to restore our patient's smile to its full attractiveness.

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# The restoration mosaic

Minimally invasive restoration of abraded dentition according to functional and esthetic aspects
*Dr Jan Kersting and Alexander Miranskij, MDT, Nuremberg/Germany*

## A well-structured treatment plan is the key to restoring badly abraded dentition. Devising this type of plan is like creating a mosaic out of numerous individual pieces.

Many different therapeutic components combine to produce a treatment solution which focuses on both functional and esthetic parameters. However, the different "pieces" have to be carefully matched in order to obtain a satisfying long-lasting result. A well-structured treatment plan is requisite, particularly in extensive restorative procedures. Continuous interaction and communication between the practitioner and the dental technician throughout the treatment and the patient's confidence in these specialists represent important components in the process of restoring the esthetics and function of the patient's dentition. In addition, the materials used play a pivotal role. The high-strength lithium disilicate glass-ceramic IPS e.max® Press offers excellent physical and esthetic characteristics, which makes it the ideal choice for many indications. Apart from its high strength, the material has a very attractive appearance, allowing exceptionally esthetic results to be achieved even if space is limited.

Fig. 1: Point of departure: Lowered vertical dimension of occlusion. The picture shows the well-developed masseter muscle on both sides of the face.

Fig. 2: Splint therapy: Customized occlusal appliance raising the vertical dimension by approx. 2,5 mm

### Initial situation

When the patient consulted our practice for the first time he had severely worn anterior and posterior teeth. The strongly built man had participated in competitive sports for many years. His facial muscles were exceptionally well-pronounced (Fig. 1). Today's dental professionals are increasingly faced with cases showing this type of pathological loss of tooth structure. Its causes include erosion (demineralization of the teeth without the involvement of microorganisms), attrition (physiological or pathological occlusal contacts) or abrasion (mechanical processes, bruxism).

### Preoperative considerations

The patient originally presented to the dental practice with the intention of having a carious lesion in tooth 46 repaired. Since we noticed the obvious dysfunction of his jaw, we explained to him the medical importance of undergoing a suitable treatment. In order to ensure the long-term success of the treatment, we first had to realign the physiological vertical occlusion. Therefore, we needed to establish the cause of the destruction, as this significantly influences the treatment planning and also the choice of the materials used in the process. Often wear is caused by many different factors. In this case, the strenuous physical activity of the client seemed to be the main contributor to the loss of tooth structure. As a result, we were able to devise a minimally invasive treatment plan for him. It was discussed with the client, and all the necessary patient details were recorded. Due to the extensive loss of vertical occlusion, the patient's physiognomy had changed dramatically. His facial features were asymmetrical and his smile was crooked. The corners of his mouth were not properly aligned. Contrary to esthetic guidelines, the curve of the lower lip was not parallel with the upper incisal edge. The incisors had been so badly abraded that they no longer formed an upward curve. Furthermore, the lower lip drooped on

Fig. 3: Wax-up incorporating the vertical dimension evaluated via the occlusal appliance

Fig. 4: The wax-up was rendered in composite by means of a silicone matrix.

the right side. The patient reported that he often clenched his teeth, especially during physical exertion. He also complained of tenseness in his jaw muscles.

**Objectives:** The dental team took on the challenge of realigning the vertical dimension, stabilizing the occlusion and creating an attractive result.

**Treatment plan:** After the occlusal splint therapy and the provisional phase, the patient would be treated with occlusal veneers ("table tops"). In order to improve the overall esthetic appearance of the dentition, we also recommended that the upper anterior teeth be restored with veneers.

**Materials:** A lithium disilicate ceramic (IPS e.max Press) was chosen for the full-contour fabrication of the lower posterior teeth. This material's high strength was a decisive factor in the decision-making. A composite was chosen for the intraoral reconstruction of the lower anterior teeth 32 to 42. The teeth would be restored with the help of a silicone matrix made from a diagnostic wax-up.

### Planning phase

The initial diagnosis involved the evaluation of intraoral and extraoral photographs and a clinical functional analysis. In addition, study models were assessed. A diagnostic wax-up that was based on a digital esthetics analysis (Digital Smile Design according to C. Coachman) delivered essential information about esthetic aspects, the vertical dimension of occlusion, the occlusal design and bite elevation. The existing structures were rebuilt in wax using an additive method, and the physiological state was restored. In this case, the wax-up was not simply used to evaluate the initial situation and guide the treatment process, it was also used as a communication device. The wax-up allowed the patient to visualize the treatment result. Furthermore, the model served to motivate him to persevere in pursuing the challenging and time-consuming treatment goals.

### Occlusal splint therapy

In the first part of the treatment, the patient was fitted with a customized occlusal appliance. The aim of the splint therapy was to restore the physiological bite of the patient. Before the appliance was fabricated, a comfortable physiologic rest position was evaluated. Furthermore, a 2.5 mm increase in the vertical dimension was diagnosed (Fig. 2). Several days after the splint was placed, the patient reported that he felt comfortable with the "old-but-new" vertical dimension of occlusion. He wore the appliance for three months, during which time he did not experience any functional problems. The muscles relaxed quite visibly.

### Stabilization of the situation

The occlusal situation that was established with the appliance was stabilized by treating the patient with long-term temporary restorations. We decided to provide him with non-invasive occlusal veneers made of composite, which would be adhesively cemented in the lower jaw. For this purpose, the study models were set up in the articulator in the arbitrary hinge axis position on the basis of a functional analysis. The anticipated final situation was waxed up according to the diagnostic setup (Fig. 3). The waxed-up restorations were recreated using composite with the help of a clear silicone matrix, and then the occlusal veneers were completed (Fig. 4). In the process, we paid particular attention to the functional and morphological principles. Next, the veneers were adhesively cemented in the mouth of the patient and the functional parameters were checked. This temporary restoration represented a decisive step in the treatment procedure and a significant component in achieving a lasting result. The patient could not be expected to wear the occlusal appliance continuously for 24 hours. The long-term temporaries, however, enabled the movement patterns to be optimally established, since they were cemented in place (Fig. 5).

### Preparation for the preservation of the supporting area

The situation stabilized within the following three months. The patient indicated that he felt very comfortable. The temporaries did not show any signs of wear. The patient was pain free. Now the time had come for the final treatment phase to begin. We had carefully assembled all the strategic pieces up to this point. At this stage, the success of the permanent restoration would depend completely on the preparation technique. Neither the horizontal nor the vertical maxillomandibular relationship could be disturbed. The sequential preparation phase started with the provisional occlusal veneers. In the first step, tooth 36, 46 and 43 were prepared (Fig. 6), and three-point support was established. Subsequently, the maxillomandibular jaw relationship was recorded (Fig. 7), and the teeth 33 to 37 as well as 44 to 47 were grounded. The teeth were prepared according to minimally invasive principles. This is currently the acceptable standard in esthetic and functional restorative treatment, since it corresponds to the requirements of patient-oriented and responsible dentistry.

Fig. 5:
Long-term temporary: The composite occlusal veneers were adhesively cemented on the tooth structure without any prior preparation.

Fig. 6:
Sequential preparation for the permanent restoration by maintaining the vertical dimension of occlusion

Fig. 7:
Bite taking after the preparation of tooth 36, 46 and 43

Fig. 8:
The prepared lower teeth

The patient's teeth showed a number of cervical lesions (damaged fillings, untreated wedge-shaped lesions). As a result, the preparation strategy was adjusted to take these lesions into account. First, the damaged fillings were replaced with composite (Tetric® Flow). Next, the now intact fillings and the wedge-shaped lesions were included in the enamel preparation and sealed with the occlusal veneers. We made sure that the preparation margins were located in the enamel and were free of composite (Fig. 8). We decided not to prepare or build up the teeth with composite in the lower anterior jaw.

### Material selection

After the impressions were taken, the study models were fabricated and mounted in the articulator in relation to the horizontal plane. Before the final mandibular restoration was completed, we discussed the esthetic and functional reconstruction of the upper front teeth (veneers for teeth 13 to 23) with the patient. We helped the client to visualize the anticipated result by building up the teeth in wax. The teeth acquired a distinctive shape and a suitable length. The wax-up was used to fabricate a mock-up, which was tried in by the patient. He was extremely pleased with what he saw and was completely satisfied with the veneer solution. Nevertheless, he wanted our assurance that we would not unnecessarily grind any healthy tooth structure.

> The preservation of tooth structure is a vital component of modern, patient-oriented treatment strategies.

State-of-the-art materials that can be cemented with adhesive methods enabled us to fulfil his wish. In this case we used

Fig. 9: The occlusal veneers were modelled with wax according to conventional wax-up principles.

Fig. 10: The successively waxed-up restorations were recreated 1:1 with ceramic (IPS e.max Press).

Figs 11 and 12: The occlusal veneers were placed with the adhesive technique and the lower anterior teeth were built up with composite. The restorations blended in smoothly with the remaining dentition. Due to its high strength, lithium disilicate can stand up to high chewing forces.

Figs 13 and 14: The ultra-thin anterior veneers were applied to pressed frameworks (cut-back).

Figs 15 and 16: The restorations in situ show a lifelike internal play of colours. A well-structured treatment plan and high-strength ceramic restorations enabled the dental team to adjust the vertical dimension of occlusion of the patient and improve his appearance quite dramatically.

ultra-thin lithium disilicate veneers which we bonded to the healthy tooth structure for long-lasting results.

## Fabrication of the final restorations

High strength was a priority in the posterior dentition. Therefore, full-contour restorations (monolithic) were fabricated with IPS e.max Press (Figs 9 and 10). The occlusal veneers were produced in wax according to customary methods. The restorations were created with ceramic using the press technique and then prepared for adhesive cementation. The teeth were conventionally prepared according to the requirements of the adhesive technique. For the permanent cementation of the restorations, we used a dual-curing luting composite (Variolink® II). The teeth in the lower jaw were built up with a highly esthetic composite resin (Tetric EvoCeram®) (Figs 11 and 12).

The upper anterior teeth (13 to 23) were prepared by removing a minimal amount of tooth structure. A model was produced and then the veneers were fabricated with IPS e.max Press HT ingots (High Translucency). The pressed veneers were cut back and customized with a veneering ceramic (IPS e.max Ceram) (Figs 13 and 14). In the layering process, we strove to achieve a lifelike appearance and therefore paid a considerable amount of attention to this step. With the help of gold powder we were able to produce a lifelike surface texture. We polished the restorations manually. All the parties involved were impressed with the result after the adhesive cementation of the restorations. The inclined all-ceramic restorations showed excellent fit and physiological function. As a result, a very natural-looking appearance was achieved (Figs 15 and 16). A lifelike play of colours was observed within the veneers.

## Conclusion

A well-coordinated treatment plan composed of many mosaic-like pieces is required in situations where complex restorative treatment including bite elevation is necessary. In the process, it is important to treat patients responsibly and inspire them with the required confidence. Careful deliberation is particularly important in the establishment of the physiological bite elevation. In the described case, a non-invasive strategy was devised to re-establish a stable vertical dimension. The teeth were ground for the preparation of the final restoration only after a suitably long temporary phase (occusal veneers made of composite) and stabilization of the bite elevation.

## All the mosaic pieces at a glance

Trust of the patient; exact analysis of the initial situation; restoration of the physiological vertical dimension of occlusion, taking functional parameters into account; stabilization of the situation; sequential preparation, including preservation of the supporting area; preservation of tooth structure; permanent restoration of the teeth, taking advantage of the possibilities offered by different materials.

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# Thin veneers – a minimally invasive approach to achieve perfect esthetics

Esthetically demanding diastema closure using thin veneers made of IPS e.max Press

*Dr Torsten Seidenstricker, MSc, Allaman, and Dominique Vinci, Petit-Lancy/Switzerland*

Conservative bonded thin veneers offer predictable outcomes in esthetically sensitive areas. Given the non-invasive preparation technique, the treatment can be carried out without any anaesthetic. With all the bonding margins located in the enamel, adhesive cementation delivers long-lasting results.

## Case presentation

A 17-year-old male patient presented at our practice with the urgent wish to have the gap between his anterior teeth remedied (Fig. 1). He was satisfied with the shade and length of his teeth. The patient's request was exclusively motivated by esthetic concerns and he expected a perfect esthetic result. An evaluation according to Tonn's method revealed a discrepancy in the width relationship between the upper and lower teeth. This inconsistency could be corrected by extending the anterior maxillary arch, which had grown too small (Fig. 2). Following intensive discussion with all individuals involved in the treatment process and explanation of what is technically feasible and medically justifiable, the patient decided in favour of a prosthetic diastema closure with ceramic veneers. Short treatment time, absence of pain and predictable esthetic results tilted the balance in favour of a prosthetic solution rather than an orthodontic one.

## Treatment planning

On the basis of preoperative models, a diagnostic wax-up incorporating the desired changes on teeth 13 to 23 was created in the dental laboratory (Vinci Dental Concept). The six upper anterior teeth in question were built up in ideal proportion and shape to simulate the closure of the diastemata on the model.

Fig. 1: The patient decided for a diastema closure with veneers.

Fig. 2: Excess space in the maxillary anterior arch in an otherwise healthy natural dentition

Fig. 3: The transparent silicone key ensures an accurate transfer of the situation established on the model to the oral cavity of the patient (mock-up).

Fig. 4: Composite mock-up

Fig. 5: The mock-up was temporarily created to allow the patient to test the intended changes for a few days

The esthetic design of the wax-up is key to all stages of the treatment process, because backward planning works back, beginning with the planned esthetic appearance of the final restoration.

A transparent silicone key was prepared over the idealized diagnostic wax-up. The silicone key assisted in accurately transferring the planned tooth proportions to the oral cavity of the patient (Fig. 3). The quality of the subsequent temporary mock-up played a pivotal role in the selection of an appropriate therapeutic strategy because it allowed us to evaluate the desired outcome on the patient without having to cut the tooth structure.

In contrast to other procedures described in the literature, the technique presented in this report enabled us to prepare a highly esthetic mock-up using an extremely effective, virtually excess-free method. The material of choice was a flowable hybrid composite; in this particular case we used Tetric EvoFlow® in shade A1. The composite was directly applied to the uncut tooth surface with the help of the silicone key and polymerized through the key. After removing the key from the oral cavity, any unwanted material (flashing) was carefully cleaned up using a probe. The interlocked temporary restoration was safe and comfortable to wear for the patient, even if it was placed without preliminary adhesive conditioning. Additionally, the temporary assisted us in determining the need for any esthetic or functional corrections (Fig. 4).

Having worn the mock-up in his day-to-day life, the patient was overwhelmed by the positive feedback he had received from his social circle and demanded a timely implementation of the final prosthetic restoration (Fig. 5). As our plan was to apply only small amounts of restorative material to the healthy tooth structure, the veneers were designed to be ultrathin. We decided for IPS e.max® Press lithium disilicate ceramic because of the strong evidence base and our long-standing clinical experience with this material. Given its tooth-like refractive index coefficient, this ceramic is ideally suited for cases with high esthetic demands. The system offers a wide selection of ingots in various degrees of translucency and opacity and allows the fabrication of 0.3 mm thick veneers, enabling a highly conservative preparation method. The ceramic press technique also ensures a high accuracy of fit.

### Preparation and impression-taking

To prevent an excessive loss of healthy tooth structure, the preparation was performed through the mock-up. The advantage of preparing a wax-up and mock-up that incorporate the final result was again evident at this stage, as every subsequent treatment step was performed with the planned final outer contour (envelope) in mind. With all the preparation margins being limited to the enamel, application of a local anaesthetic was not necessary. Sparing as much tooth structure as possible, we prepared a thickness of 0.3 mm for the ceramic veneers (Fig. 6). A small retraction cord was applied

Fig. 6: Minimal layer thickness of the ceramic veneers made of IPS e.max Press

Fig. 7: The cut-back technique allows the pressed lithium disilicate ceramic (IPS e.max Press) to be customized.

to protect the gingiva while finishing the preparation margin. To attain a harmonious emergence profile from the gingiva, the interdental preparation margin was located towards the palatal and apical region. Additionally, the preparation was slightly extended to the intrasulcular area to achieve an enhanced emergence profile. The teeth were reduced incisally to allow a layer thickness of 1 mm for the planned incisal edge. The functional palatal regions of the teeth were not involved in the restoration. A final impression was taken with the retraction cord still in place. An IPS Natural Die shade guide was utilized to determine the shade of the preparation. Intraoral photos were taken to inform the lab of the individual characteristics to the teeth.

## Laboratory procedure

With the help of the silicone key, the situation tested during the mock-up phase was transferred one-to-one to the final situation. In view of the desired A1 shade, a medium-translucency IPS e.max Press MT ingot in shade B1 (previously known as Impusle V1) was selected for pressing the veneers. This material exhibits excellent colour characteristics in bright shades. To match the age of the patient, the incisal area and surface texture were designed without any major abrasion marks (Fig. 7). By using the cut-back technique in conjunction with the IPS e.max Ceram layering method, key areas were individually emphasized. For instance, the translucency of the mesial and distal marginal ridge and the inciscal edge was increased by applying Essence powder in Ocean shade. After the stain and characterization firing, the veneers were layered with IPS e.max Ceram enamel materials: Opal 1 was used for the incisal edge, Opal 3 and 4 for the mesial and distal marginal ridges and Transpa 1 for the remaining enamel surface. After glaze firing, surface characteristics were added using silicone polishers, followed by polishing with diamond paste. An intraoral try-in session in the lab allowed the dental technician and patient to fine-tune the appearance of the restoration down to the last detail (Fig. 8). This is a risk-minimizing step that helps save time at the dental chair.

## Try-in and insertion

Adhesive cementation of ceramic veneers is a routine procedure. To insert the wafer-thin all-ceramic restorations, Variolink® Veneer light-curing luting composite was used. The preparation was thoroughly cleaned using a rubber cup and fluoride-free polishing paste (Proxyt) and then rinsed with water spray. After that, all the veneers were placed at the same

Fig. 8: A try-in session in the lab allowed the technician and patient to fine-tune the restoration down to the last detail.



Fig. 9:
Final restorations 13 to 23, one week after insertion

Fig. 10:
The patient is pleased with his new smile.

time to verify their proximal contact relationships. To achieve an esthetically optimal outcome, the colour integration of the restorations was assessed using try-in pastes. An occlusal check was carefully conducted. The patient was able to evaluate the overall esthetic impression in a mirror and judge for himself if the mock-up was faithfully transferred to the final restoration to meet his expectations. Etching the lithium disilicate ceramic with 5% hydrofluoric acid for 20 seconds (IPS Ceramic Etching Gel) is mandatory and in this case was instrumental in reliably removing any residual try-in paste before the restorations were permanently seated. Adhesive cementation was performed according to the manufacturer's instructions. A look at the detailed cementation protocol may be of additional assistance. The protocol is available online at "www.cementation-navigation.com".

## Conclusion

Backward planning, epitomized by the silicone key of the mock-up, was central to all the stages of the treatment. The secret to a predictable, esthetically perfect outcome lay in breaking up the complex treatment into manageable individual steps that could be safely implemented. The patient was completely satisfied in all respects with the treatment and its results. The entire treatment was completely pain free due to the conservative nature of the intervention. The palatal surfaces of the incisal teeth remained unaffected by the treatment and were not subjected to any functional adjustments. Lateral excursive movements were possible through canine guidance and had a protective effect on the anterior restorations. Regular recalls and professional tooth cleaning are essential for the long-term success of this kind of restorations. Figures 9 and 10 show the esthetic outcome.

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# Natural-looking imitation of pink esthetics

Completing a denture base using the IvoBase System

*Carsten Fischer, Frankfurt on the Main/Germany*

Even in the case of complex prosthetic reconstructions, patients want their dentures to look natural in addition to having the basic functions (speaking, chewing, tasting) returned to their stomatognathic system. Dentures should by no means have an adverse effect on the patient's esthetic appearance. Esthetic soft tissue design reflects this philosophy.

The IvoBase® denture base system offers an efficient method to create custom-made esthetic soft tissue reconstructions. The patients' expectations can be ideally met with a flair for esthetic design and a combination of three materials – IvoBase denture base material, SR Nexco® light-curing lab composite (customization) and ideally designed denture teeth.

**IvoBase System**

The IvoBase System is based on a fully automated injection and polymerization process. All the components (flasks, capsules, injector, etc.) are coordinated with each other. Chemical shrinkage of the resin is compensated during the polymerization process due to thermal management in the flask. As a result, volumetric shrinkage is prevented by the continued supply of additional material during the polymerization process to provide a denture base that demonstrates a high accuracy of fit and an excellent surface finish. Chemically, the IvoBase denture base materials fall into the category of self-curing polymers but offer the qualitative advantages of heat-curing polymers. As the self-cure process of IvoBase commences at a starting temperature of 40°C, thermal shrinkage is reduced compared with that of conventional heat-curing polymers. Monomer and polymer are supplied in predosed capsules to ensure an optimal mixing ratio and to eliminate direct skin contact with the monomer. The IvoBase System results in denture bases that demonstrate lifelike pink esthetics and closely resemble the light-optical properties of the natural gingiva. Characterizations can be easily applied to the denture bases to accommodate the specific expectations of the patient.

Fig. 1: Esthetic try-in of the wax-up

Figs 2 and 3: Wax-up after successive contouring of the soft tissue parts in wax

Fig. 4: The teeth are conditioned and the stone parts isolated.

Fig. 5: The inhibited opaquer layer is removed and the framework repositioned on the framework.

Fig. 6: The flask and IvoBase mixture are placed in the injector and the program is started.

### Case presentation

A partially edentulous upper jaw was to be restored with a palate-free denture retained with telescopic crowns. The inner (primary) zirconia copings for teeth no. 13, 14, 15 and 23, 24, 25 were sheathed with electroformed copings (secondary parts) attached to a tertiary structure made of base alloy. The electroformed copings were cemented to the base alloy structure in the oral cavity to ensure a tension-free fit. Tooth setup was performed according to conventional prosthetic principles while the static and functional requirements as well as the patient's individual expectations were taken into account. Tooth position, smile line, lip volume, phonetics and other criteria were checked in the course of an esthetic try-in (Fig. 1) before fabricating the final denture. Natural-looking artificial gingiva parts were already achieved in the wax-up and the soft tissue areas were individualized with subtle but effective touches (Figs 2 and 3).

### Lab procedure

After both the dentist and patient had approved the wax-up, the denture was ready to be processed into acrylic. To perform this task, I used the IvoBase denture base system, which allowed me to transfer the wax-up to the final restoration without loss of detail.

The injection-based system provides a clean, accurate, safe and straightforward working method.

### Investing and boiling out

Both flask halves were identical. Prior to investing the model, I placed the flask lid, access former half and filter wax component in one of the flask halves. After applying a thin coating of petroleum jelly to the inner surfaces of the prepared flasks, I soaked the model with the mounted waxed-up denture with water and isolated it with stone-to-stone separating fluid. The model was now ready for being invested in plaster; a Class III dental stone is recommended for this purpose. I took care to place the model at the centre of the flask and to ensure a space between the anterior margin of the model and flask of approx. 10 mm. To create a flush surface between the edge of the model and the flask housing, I removed all surplus plaster whilst it was still soft. The stone surface should be flush with the access former to prevent the plaster from spalling during the subsequent working procedure.

After the stone had hardened, I replaced the access former half with the access former full and positioned the prefabricated injection wax component. As a palate-free denture base was fabricated in the present case, the sprues were pressed onto the maxillary tuberosity. I made sure that the sprue was contiguous in all areas of the denture base. Then, I attached what are known as aeriation channels at the anterior region to vent the flask cavity during the injection process. These components were also prefabricated and were easy to connect to the denture base. Important: the aeriation channels must not come into contact with the flask housing. Next, I coated the teeth and gingival areas with a medium-body addition curing silicone (A-silicone of a shore hardness of 65) and then applied some stippling to the silicone before it had set to create a retentive pattern and secure the silicone in the stone. No silicone was applied to the occlusal surfaces and access former. After isolating the stone surface, I positioned the upper flask half and locked the flask halves using the locking clasp. Then, I filled the flask with dental stone (Class III) with the help of a vibration device to avoid air bubbles. Excess stone was skimmed off so that a flush surface resulted between the stone and flask lid. Once the stone had set, the flask was heated in a water bath at 90°C and then the two flask halves were separated. The wax was now soft and could be easily removed in large pieces. After the full access former had been taken out, the model and teeth were boiled out with clean boiling water to thoroughly remove all wax residue.

### Transfer to acrylic

The basal surfaces of the cleaned teeth were roughened with jet medium and mechanical retentions applied with a small round bur. After that, I returned the teeth to the silicone key. Next, I applied a thin coating of Separating Fluid to the stone surfaces of the cooled flask halves (Fig. 4). Prior to joining the flask halves, I masked the base metal alloy framework with opaquer. For this purpose, I used a pink opaquer for the gingival areas and a tooth-coloured shade for the areas under the telescope teeth. These materials were first applied as a foundation layer and then in a covering layer. Once the framework had been thus prepared, it was placed on the model and

Fig. 7: Careful divesting after the fully automated polymerization process

Fig. 8: Finishing requires only a few steps as the wax-up is processed into the acrylic without loss of accuracy.

Fig. 9: Light-curing SR Nexco composite can be optimally combined with the IvoBase System to characterize the denture base.

Fig. 10: A thin coating of bonding agent is applied to the gingiva-coloured parts,...


Fig. 11: ... allowed to react and then cured with light.

Fig. 12: Characterization: subtle stippling and fine red blood vessels enhance the natural appearance of the prosthetic gingiva parts.

Abb. 13: The individual SR Nexco materials can be adapted using a disposable sponge.

secured with wax (Fig. 5). The aeriation filter, centring insert and funnel were inserted and the flask halves assembled.

The denture base materials are available in seven shades. For the case presented here, I selected IvoBase High Impact in shade 34-V. I removed the monomer container from the pre-dosed capsule, joined the fluid and powder and mixed the two components to a homogenous mixture. With a few easy manipulations I attached the centring insert and flask to the capsule and then placed them into the injector according to the manufacturer's instructions. Next, I selected the relevant injection program and then started the injection process (Fig. 6). The process was fully automated and, with the RMR function added, took approx. 65 minutes to complete. The RMR function further reduces the already very low content of residual monomer to below one per cent. As the injection and polymerization process were exactly matched to the material, chemical shrinkage was completely compensated. Once the program had been complete, I removed the flask and cooled with water. Divesting was performed under a dental press. The IvoBase System includes a divesting aid to facilitate this process. Having detached the flask halves, I carefully removed the denture from the stone core and separated the capsule using a separating disc (Fig. 7). All waxed-up areas were faithfully reproduced in the acrylic.

**Completing the denture**

Now, I directed my full attention to finishing the denture. The advantage of using this system became most apparent at this stage, as hardly any reworking was necessary. The finely modelled surface structures and textures of the wax pattern were replicated in the acrylic without loss of detail. In a few quick steps the denture base was ready for final customization (Fig. 8). With SR Nexco, the artificial gingiva can be given an individual touch and natural-looking characterizations to suit the patient's expectations. SR Nexco ideally complements the IvoBase denture base material (shade 34 V) (Fig. 9).

I applied a light-curing conditioner (SR Connect) to the acrylic surface to create an adhesive interface that would allow

Fig. 14: The tooth replacement harmoniously integrates into the patient's face and satisfies his esthetic expectations.

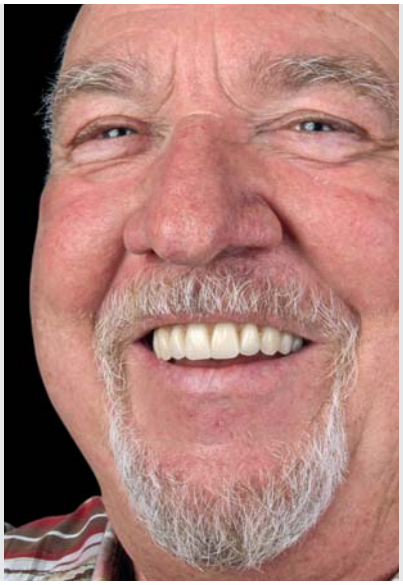

Fig. 15: Successful interplay between light, shadow and shade. The surface texture modelled in wax has been processed into acrylic without loss of detail using the IvoBase System. The resulting light dynamic properties convey a natural appearance to the artificial gingiva.

the application of individual shade characterizations (Figs 10 and 11). After that, I focused on creating subtle details to reproduce a natural depth effect. I customized the vestibular areas and applied fine capillaries on the facial side using a variety of different shades. Key anatomical features should be borne in mind when characterizing soft tissue parts to achieve a lifelike reproduction. For instance, keratinized gingiva has a light pink colour because less blood normally flows through it. By contrast, the mucogingival areas receive a far larger supply of blood and are interspersed with fine blood vessels. These details were easy to reproduce with the SR Nexco range of materials. Aspects of three dimensionality including alveoli and festooning were already created in detail in the wax-up and transferred to the acryclic without loss of detail using the IvoBase System. The SR Nexco gingiva materials and my technical skills enabled me to individualize the prosthetic gingiva by applying materials in different shades in a targeted fashion to attain a natural-looking final result (Figs 12 and 13).

Prior to final light-curing, I covered the entire surface with an oxygen-tight glycerine-based gel (SR Gel) to prevent the formation of an inhibition layer. After completing the final polymerization process, I polished the surface. The use of goat's hair brushes, a high-gloss buff and Universal Polishing Paste effectively resulted in a superbly smooth and glossy surface, without loss of surface texture or shade characteristics.

**Result**

Pink esthetics that very closely resembles healthy soft tissue is the result of this approach. Fine details of texture – such as subtle stippling, slightly accentuated alveoli or free gingiva margins – give artificial gingiva a natural appearance. The IvoBase denture base material beautifully harmonizes with the SR Nexco composite and together, these two materials create natural light reflections and a dynamic interplay of colours. The compact and smooth surface is not only esthetically pleasing but also provides optimum conditions for denture hygiene (Figs 14 and 15).

**Conclusion**

The IvoBase injection process provides a straightforward method to process waxed up denture bases into high-quality PMMA. Waxed-up setups can be transferred 1:1. Polymerization shrinkage is mostly compensated, thus minimizing the effort required by the dental technician. The soft tissue parts can be customized to meet the individual expectations of the patient and to provide dentures with natural-looking pink esthetics.

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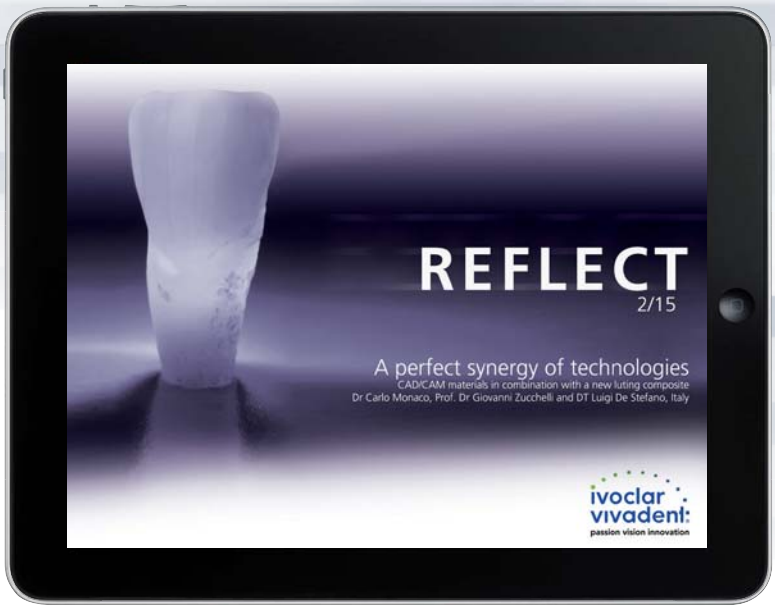


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