REFLECT

3/15

Innovative adhesive luting protocol

All-ceramic anterior crowns

Technology meets craftsmanship

Prosthetic restoration of an edentulous upper jaw using zirconium oxide

A good option for the recreation of gingival tissue

Esthetic composite layering of implant-supported restorations

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Dear Readers

As everywhere else, competition in the dental world is becoming increasingly tough. Dental professionals face not only the challenge of offering their patients and customers quality and esthetics of the highest level but also the challenge of delivering the desired results cost-effectively and efficiently. The time factor plays an increasingly prominent role. Ever more patients expect demanding results in as little time as possible.

Against such a background, the dental industry has the task to provide dental professionals with materials, product systems and processes that enable them to meet these challenges. It is no coincidence that dental manufacturers keep launching new products. The year 2015 has again spawned many innovations, not least because of IDS.

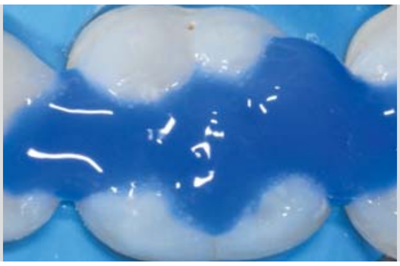
The current issue of Reflect once more affords you an insight into the astonishing results that dentists and dental technicians around the globe have achieved either on their own or by working in teams – results that have given much joy to their patients. In some cases, new treatment options that until recently were not available have been employed.

We have again been able to bring together a fascinating mix of writers and topics. Learn more about what's cooking with our high-calibre case reports in Fixed and Removable Prosthetics and Direct Restoratives.

I wish you an enjoyable read!

Yours 

Daniela Prelog
Managing Director
Ivoclar Vivadent SAS France



Page 10

Page 14

Page 18

DENTISTRY

Innovative adhesive luting protocol
All-ceramic anterior crowns (IPS e.max lithium disilicate)
placed with Monobond Etch & Prime
Prof. Dr Claus-Peter Ernst 4

Proven esthetics: six years of success with IPS Empress Direct
Direct restorative procedure using a nano-hybrid composite
Dr Sandro Pradella 8

TEAMWORK

A good option for the lifelike recreation of gingival tissue
Esthetic composite layering of implant-supported restorations
in an edentulous jaw
Dr Patrice Margossian and Pierre Andrieu 12

tablet version available

Technology meets craftsmanship
Prosthetic implant restoration of an edentulous upper jaw
using zirconium oxide
Dr Dario Žujić, DT Velimir Žujić and DT Dragan Stolica 16

Together towards pink-white esthetics
Communication is the foundation for natural-looking results
Dr Jorge André Cardoso, DT Oleg Blashkiv, Dr Rui Negrão
and Dr Teresa Taveira 20

Take advantage of the versatile options offered by digital magazines for tablets and experience the article: "Technology meets craftsmanship" by Dr Dario Žujić, DT Velimir Žujić and DT Dragan Stolica, (pp. 16-19). Benefit from the interactive photo sequences with additional pictures, and learn more about the products used and the authors.

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Innovative adhesive luting protocol

All-ceramic anterior crowns (IPS e.max lithium disilicate) placed with Monobond Etch & Prime
Prof. Dr Claus-Peter Ernst, Mainz/Germany

Until now, the conditioning of glass-ceramic restorations consisted of etching the contact surface with hydrofluoric acid and then silanizing it. Monobond Etch & Prime is a single-component primer which allows ceramic surfaces to be etched and silanized in one step.

Anterior crowns come in many different variations from purely functional to highly esthetic – depending on the requirements and means of the patient, the skill of the dental technician, the availability of materials and the preparation and cementation procedures used. Many anterior crowns that were considered to be esthetic in the past no longer meet the demands of today's patients. The example below is a case in point.

Case presentation

When she came to our practice, the biggest wish of the twenty-year-old high-school graduate was to have the crowns on her two central incisors replaced (Fig. 1). At the age of 14, she had experienced anterior tooth trauma which apparently damaged the mesio-incisal part of the incisal edge of both teeth. In the dental practice which the patient consulted at that time, the teeth were restored with PFM crowns. Even though the extent of the trauma can no longer be assessed, today's alternative – in light of the patient's young age in particular – would most probably have been a direct composite restoration.

Figure 2 shows the two central incisors in detail from a labial aspect. Figure 3 shows an incisal view. The crowns did not exhibit any functional defects. As a result, the

Fig. 1: Unattractive, old PFM restorations on tooth 11 and 21 in a twenty-year-old patient

Fig. 2: Close-up photo of the functionally intact anterior crowns showing unattractive PFM work due to the metal framework showing through

Fig. 3: Incisal view of the existing crowns

main treatment aim was to improve the esthetic appearance of the anterior teeth as requested. Subsequently, the patient was informed about the treatment procedure – in particular about any possible additional preparation requiring the removal of tooth structure – and the cost of the treatment. The actual treatment started in a separate appointment.

The restorations were fabricated by the dental laboratory of Hildegard Hofmann (Mainz, Germany). Pressed all-ceramic IPS e.max® crowns were selected for this case, since they are the first choice for this type of indication. This has been confirmed by numerous clinical studies, including the recently published German S3 Clinical Practice Guideline on ceramic restorations.

The teeth were anesthetized at the placement appointment. The crowns were removed and the bonding surfaces were carefully cleaned with ultrasound and a fluoride-free cleaning paste. Since the new Variolink® Esthetic was chosen as the luting material, the crowns were tried in with the corresponding try-in pastes. An immediate match to the adjacent and the mandibular anterior teeth was achieved with the "Neutral" shade. No adjustments were necessary with regard to a lighter ("Light") or darker ("Warm") shade of the luting composite. We attributed this excellent match to the fact that the dental technician had selected the shade at the chairside. The extra expense of this step far outweighs the inconvenience of having to make numerous adjustments or new restorations because of a shade mismatch.

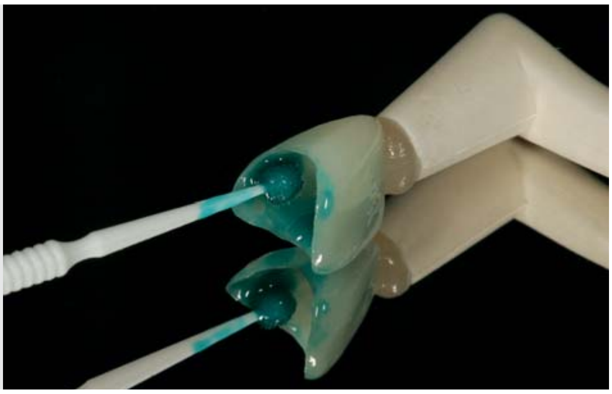

Fig. 4: The self-conditioning ceramic primer Monobond Etch & Prime is scrubbed in for 20 seconds

Conditioning of the crown

Saliva and residue of the try-in paste were removed (Ivoclean) from the crowns before they were conditioned. It is advisable to fabricate a "handle", which will allow the inner crown surfaces to be conditioned without having to touch the crown with the fingers. In this case, the crowns were attached to a brush holder with a light-curing provisional composite. This "handle" also allowed the crowns to be placed with ease during the luting procedure. As an alternative, an OptraStick® could have been used.

Hydrofluoric acid etching of glass-based ceramics and subsequent silanization has been an accepted conditioning method for decades. The latest studies confirm its effectiveness. It even generates a strong bond on state-of-the-art ceramic materials such as hybrid ceramics.

Due to occupational safety reasons, however, hydrofluoric acid etching is considered to be one of the most critical working steps in the dental practice.

An acid concentration of 5 % has been established, which represents a reasonable compromise according to the latest research.

The new Monobond® Etch & Prime, which was introduced at IDS 2015, is an ammonium polyfluoride-based conditioning material. The product is actively scrubbed on the bonding surface (Fig. 4) for 20 seconds. In the process, it removes any contamination with saliva or silicone. After another 40 seconds (Fig. 5), the ammonium polyfluoride reacts with the ceramic surface and produces a rough etch pattern. Even though this pattern is not as pronounced as that of

Fig. 5: Additional reaction time of Monobond Etch & Prime of 40 seconds

Fig. 6: Apical view of the IPS e.max Press crown after Monobond Etch & Prime was rinsed off

conventional 20-second etching with five-percent hydrofluoric acid, the bonding results achieved in both cases are comparable. The enlarged surface created in this way helps to activate the ceramic bonding surface.

The restoration is subsequently rinsed to remove the ammonium polyfluoride and its reaction products. Then the reaction of the silane and the activated glass-ceramic begins. A thin layer of chemically bonded silane remains on the ceramic after its distribution with blown air. This product, therefore, combines the steps of hydrofluoric acid etching and silanization and it even appears to render cleaning with Ivoclean superfluous. The currently available in-vitro data justifies using this new product with due care to replace the hydrofluoric acid etching and silanizing method. Even though it has not been shown to improve the bonding values in relation to the established references, no negative effects on the adhesive bond have been found to date either. Nevertheless, since the adhesive bond to glass-ceramics is considered to be the most unproblematic interface in the bonding process of indirect restorations, no clinical irregularities are to be expected.

In the case presented, the crowns could even have been placed by conventional or self-adhesive means. The loss of retention would have been as unlikely as the occurrence of a ceramic fracture due to inadequate adhesive support. Figure 6 shows one of the two crowns after Monobond Etch & Prime had been rinsed off and the surface dried with blown air.

Cementation of the crowns

The new Varliolink Esthetic DC was used for the adhesive cementation of the crowns. As this luting system is a full adhesive, sufficient moisture control must be ensured. Due to the equigingival preparation margin, the healthy condition of the gingiva and the excellent cooperation of the patient, the placement of a rubber dam was not essential. Therefore,

Fig. 7: Conditioning of the prepared teeth for the adhesive cementation of the restorations under cotton roll isolation. A retraction cord (Ultradent) was placed in the sulcus to prevent any contamination with sulcus fluids.

Fig. 8: Incisal view of the prepared teeth

Fig. 9: Application of Adhese Universal adhesive with the pen applicator

Fig. 10: Light polymerization of the adhesive after careful distribution with blown air

Fig. 11: The polymerized adhesive layer on tooth 11 and 21

Fig. 12: The IPS e.max crowns cemented with Variolink Esthetic DC at the follow-up examination after four weeks

Fig. 13: Incisal view of the crowns at the follow-up examination after four weeks

Fig. 14: Front view of the anterior teeth. A significant esthetic improvement over the initial situation has been achieved.

Fig. 15: Portrait of the happy patient

cotton roll isolation was used to seat the crowns. Two retraction cords (Ultradent) were placed to prevent any contamination with sulcus fluids (Figs 7 and 8).

The bonding surfaces were cleaned with a fluoride-free prophy paste. Next, Adhese®Universal adhesive was applied from the pen applicator (Fig. 9). The remaining thin enamel margin was not etched to prevent any gingival bleeding. Adhese Universal was scrubbed into the conditioned tooth surface for > 20 seconds as stated in the directions for use. According to the manufacturer, this time must not be reduced: It is not enough to simply paint the adhesive on the tooth surface! Next, the adhesive was dried with blown air until an immobile, glossy film was left. Then the adhesive was light-cured for 10 seconds (Fig. 10). Since the universally compatible adhesive forms a considerably thinner film than Heliobond, for example, it can be light-cured without encountering any subsequent problems of fit or bite elevation. The polymerized adhesive layer on tooth 11 and 21 is visible in Figure 11.

Figures 12 and 13 show the adhesively cemented IPS e.max LS_2 crowns at the final follow-up appointment, four weeks after the treatment. The gingiva is free from any irritation and the crowns blend in smoothly with the surrounding teeth. The tremendous improvement in the appearance of the front teeth, which was achieved with the all-ceramic restorations on tooth 11 and 21, is visible in the close-up photo shown in Figure 14. For the first time in many years, the satisfied patient dared to smile again (Fig. 15).

Conclusion

It takes quite a bit of courage to use innovative products and procedures, such as the ones described here. Adequate clinical data is not yet available, let alone the much needed long-term studies. Nonetheless, a start must be made somewhere. For those dental practitioners who would like to be rid of hydrofluoric acid sooner rather than later, the described self-conditioning glass-ceramic primer may offer an interesting option.

Since the etching time has a significant influence on the strength of the ceramic when hydrofluoric acid is used to condition ceramic restorations, the specifications of the manufacturer must be strictly observed. IPS e.max LS_2 should be etched for 20 seconds if 5 % hydrofluoric acid is used. Other conventional glass-ceramics require 60 seconds of etching. Dentsply/Degudent recommend that their material Celtra is etched for 30 seconds. The reaction time of Monobond Etch & Prime is 60 seconds on all types of ceramics. Thus it offers a first step in the direction of error prevention. It remains to be seen if external studies can confirm the effectiveness of the product in establishing an adhesive bond on ceramics other than those from Ivoclar Vivadent.

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Proven esthetics: six years of success with IPS Empress Direct

Direct restorative procedure using a nano-hybrid composite

Dr Sandro Pradella, Eremo di Curatone/Italy

After having successfully used the nano-hybrid composite IPS Empress Direct in clinical practice for six years, the author draws a balance. The teeth of the first patient he restored with this material are still in an excellent condition. Based on this first patient case with IPS Empress Direct – a new product at the time – the author explains how he successfully uses the material in direct restorative procedures.

The introduction of nano-filled composite resins went hand in hand with the evolution of conservative dentistry, which placed a major focus on the preservation of healthy tooth structure. Highly advanced composite restoratives, which feature excellent biomechanical and esthetic properties, are ideally suited for the direct restoration of large defects. This has also been confirmed by the latest clinical trials that focused on adhesive and layering techniques. In addition, there is a growing demand for highly esthetic restorations at affordable costs among patients.

Introduction

The chemical composition plays a crucial part in highly esthetic restorative materials. The chemical formula provides the restorative with the ability to meet the material performance criteria related to volumetric shrinkage, surface hardness, fracture resistance, modulus of elasticity, polishability, wear resistance and radiopacity. The optical properties of the fillers and polymer matrix also need to be perfectly matched to one another. This is paramount to achieve the shades and translucencies required for a natural looking restoration.

Each component of a composite fulfils a specific function. The monomers, for instance, influence the reactivity, strength, shrinkage and handling properties of a composite.

> Fillers of various chemical structures and sizes are embedded in the monomer matrix and determine the wear resistance, strength, polishability, gloss, radiopacity and translucency of the material.

When the nano-hybrid composite IPS Empress® Direct was developed, particular care was given to its composition. The result is a composite that is characterized by innovative properties:

1. Wear and fracture resistance

The wear behaviour of a filling material represents an essential parameter in the survival rate of a restoration. Wear affects the esthetic appearance and oral function of a restoration. Fracture resistance also has a decisive effect on the clinical performance and should be considered when choosing a composite. Restorations are subject to severe and long chewing cycles. If an unsuitable composite is used, the restoration may develop cracks over time. These cracks may impair the effectiveness and longevity of the restoration. Due to the use of nanotechnology, the fillers used in IPS Empress Direct are very small (100 – 400 nm). The composite features a high filler content (approx. 75 – 79 % by weight and approx. 52 – 59 % by volume, while the organic component (resin matrix, bis-GMA in this case) is signifi-

Materials	Hardness	Shrinkage
Enamel	408	
Dentin	60	
Amalgam	120	
Gold alloy type 3	135	
Macrohybrid composite	41 – 77	4.5 %
Microhybrid composite	74 – 120	3 %
Nanohybrid composite	160 – 185	1.6 – 2.5 %

Table: Surface hardness and shrinkage of various restorative materials [1, 2] cantly reduced. The filler particles are embedded in the resin matrix, which represents the weaker component of the two. As a result, the surface hardness and fracture resistance of IPS Empress Direct is higher than those of conventional composites. These properties are affected not only by the filler volume but also by the type of filler used in the material. Relatively coarse barium glass fillers (0.7 µm) are used in the dentin materials to achieve more strength. By contrast, the enamel materials contain smaller barium glass fillers (0.4 µm) to enhance their polishibility and gloss and to decrease their susceptibility to wear.

2. Polymerization shrinkage

As only the organic component shrinks during polymerization, nano-hybrid composites also offer advantages over conventional composites with regard to polymerization shrinkage (see chart on previous page). Due to the high content of nanofillers, the organic component is reduced to a minimum. As a result, their shrinkage rate is as low as 1.6 to 2.5 %, while microfillers demonstrate a shrinkage of 3.5 %.

5. Esthetics

Restorations that blend in seamlessly with the oral surroundings can be created by selectively choosing a dentin material with an optimum level of opacity and an enamel material with ideal translucency. Applying the materials in layer thicknesses similar to those of the natural dentin and enamel is recommended to ensure an optimum result with only two materials.

6. Handling and sensitivity to light

IPS Empress Direct is easy to use and is characterized by low sensitivity to light. This means that practitioners have plenty of time to process the material before it begins to harden due to the blue light contained in ambient light (after 240 to 300 seconds). (Source: Scientific Documentation IPS Empress Direct, Ivoclar Vivadent)

Case report

The author describes the restoration of an entire fourth quadrant, involving IPS Empress Direct as the restorative material. At the time, the rehabilitation comprised both dental arches.

Figs 1a and b: Preoperative situation: Defective amalgam and composite fillings in the upper and lower arch.

3. Optical properties

IPS Empress Direct has been designed to be a highly esthetic restorative that very closely emulates the optical properties of the natural dentition. Fluorescence, opalescence and translucence are essential characteristics of this restorative. The composite is now available in the additional new shade Translucent Opal to reproduce the opalescence of natural teeth. It is available in higher levels of translucency than conventional composites. Additionally, its high radiopacity assists dentists in telling the filling material from the healthy tooth structure and secondary caries.

4. Gloss and surface roughness

A highly esthetic composite should be easy to polish to a high gloss. The polishing and surface characteristics of IPS Empress Direct have been thoroughly investigated. For instance, the enamel materials contain barium glass fillers (0.4 µm), which promote favourable polishing properties and a high surface gloss. If polished correctly, the composite achieves approx. 80 gloss units (GU) and a low mean surface roughness of less than 0.1 µm.

The patient requested the treatment because of his postoperative sensitivity. Moreover, the existing restorations were defective and esthetically unpleasing (Figs 1a and b). The proximal contact surface between tooth 46 and tooth 47 seemed to be incorrectly shaped, as after each meal, food particles got trapped in the interdental space. Moreover, there were no occlusal contacts, and a functional occlusal surface was not present.

A rubber dam was placed in the area of the quadrant in question to create a completely dry treatment field (Fig. 2). The rubber dam technique results in an ideal treatment field. Excellent visibility is ensured and any unintended swallowing of materials by the patient is prevented. The old fillings were removed and the underlying carious tissue was excavated using a round bur.

Subsequently, the cavities were finished with fine-grit diamond grinders and diamond-coated tips in an ultrasonic handpiece. In general, care should be taken to provide the cavities with an appropriate shape. The aim is to maintain as much contact enamel and underlying supportive dentin as

Fig. 2:
Rubber dam placement to isolate the treatment field

Fig. 3:
After the old fillings and the carious tissue had been removed, the cavity was prepared according to the principles of the adhesive technique.

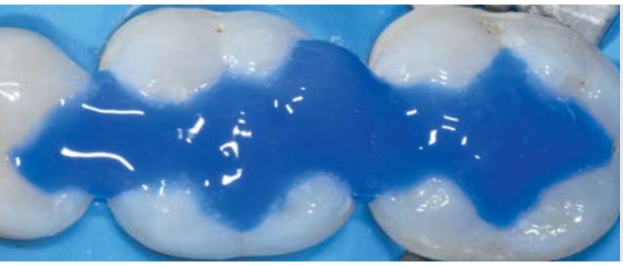


Fig. 4:
Phosphoric acid was applied and left to react for 15 seconds on dentin and 30 seconds on enamel.

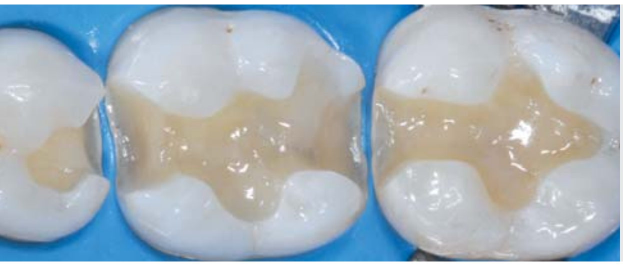


Fig. 5:
A slightly wet shimmering dentin surface is an indication of a correctly conditioned tooth structure.

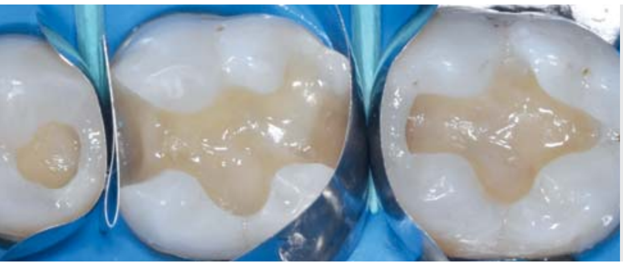


Fig. 6:
After lining the cavity with Tetric EvoFlow (to create an even cavity floor), sectional matrices were placed.

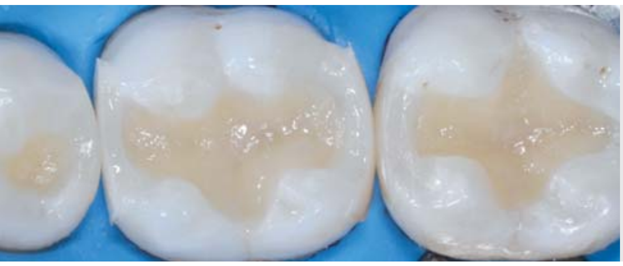


Fig. 7:
The sectional matrices provided support in reconstructing the proximal cavity walls with IPS Empress Direct enamel materials. Class I cavities were created.

Fig. 8:
IPS Empress Direct Dentin was used to successively rebuild the cusp slopes.

possible. The cavity should feature a continuous outer boundary line (Fig. 3).

Conditioning

A multiple-step total-etch adhesive (Syntac®) was used as the bonding agent. The author had already used this bonding agent for nearly 15 years at the time. Three positive outcomes underscore the clinical strength of this adhesive: i) There was no postoperative sensitivity, ii) the restorations demonstrated optimum adhesion to the underlying tooth structure and iii) they showed exceptional marginal integrity. When the total-etch technique is used, the enamel and dentin surfaces are etched for different lengths of time (enamel = 30 seconds, dentin = 15 seconds) (Fig. 4). After the etching process, Syntac Primer was slightly rubbed into the tooth structure, left to react for 20 seconds and then carefully dispersed with air until complete evaporation. The same procedure was repeated with Syntac Adhesive. The subsequently applied bonding agent (Heliobond) should remain on the etched tooth surface for at least 10 seconds. Only in this way can the material completely penetrate the collagen fibres and the partly demineralized dentin layer. After the bonding agent had taken effect, the material was carefully removed by suction and dispersed with air. After curing, the dentin surface should have a slightly glossy appearance (Fig. 5). This shows that the adhesive has penetrated thoroughly and there are no areas with an unduly thick coating of adhesive.

Filling

In an initial step, flowable composite (Tetric EvoFlow®) was applied to the entire dentin surface in a layer of approx. 0.5 mm thickness and to the enamel in a thin layer. The composite material was cured twice for 10 seconds using a curing light with a light intensity of at least 1000 mW/cm². Subsequently, the restoration was built up using the sculptable IPS Empress Direct. The objective was to turn the class II cavity into a class I cavity. This required the proximal cavity walls to be reconstructed (Figs 6 and 7). Unlike matrix bands, sectional matrices enable the composite build-up to be given the convex shape typical of proximal surfaces.

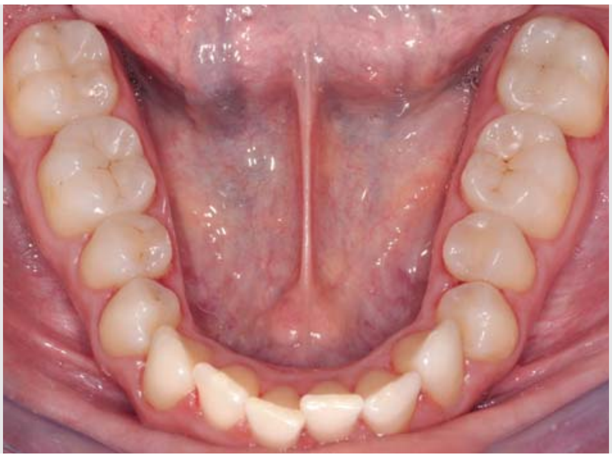
As far as matrix systems were concerned, we had to completely rethink our way of using them. In amalgam fillings, matrices served the purpose of keeping the material in place during condensing. They also prevented the amalgam from slipping into the interdental spaces, which may result in damage to the soft tissue. By contrast, the application of composites may be compared to the injection moulding procedure employed in the manufacture of plastics. In order to achieve a smooth, shiny surface, the soft plastic is injected into a metal mould. The resulting product normally does not require any further finishing. The sectional matrices used in the case presented here serve a similar purpose as the metal moulds: They define the final shape when the proximal walls are reconstructed. IPS Empress Direct enamel material was adapted appropriately and then light-cured. Due to the smooth surface, hardly any finishing was required.

The cavity was filled up with a series of first horizontal and then oblique layers of IPS Empress Direct Dentin. As a basis for the occlusal surface topography, triangular cusp slopes were shaped (Fig. 8).

Fig. 9: Creating a functional, anatomically correct occlusal surface texture

Fig. 10: View immediately after finishing and polishing. The restorations blend seamlessly with the surrounding dentition.

Fig. 11: The same situation six years later. The fillings are still intact. No marginal leakage is observed.



Figs 12a and b: Occlusal view six years after the complex rehabilitation of the upper and lower arch

The occlusal surface was completed with oblique layers of IPS Empress Direct Enamel (Fig. 9). After the matrices had been removed, the occlusal surfaces were moulded according to gnathological principles. The occlusion was verified and any premature contacts eliminated. Finishing of the occlusal surface was performed with tungsten carbide grinding instruments (H390F, Komet). Only few fine finishing and polishing steps were required. Finishing was achieved with a three-step polishing system (Astropol®) (Fig. 10). For the finishing of convex areas, we recommend using single-bladed grinding discs with decreasing grit-size (OptiDisc®, Kerr-Hawe).

Conclusion

By consistently adhering to the protocol shown, even complex direct restorations can be fabricated in a fairly uncomplicated manner. In the case presented, the three basic criteria for a satisfactory outcome could be met: appropriate shade, shape and function. Even six years after the treatment, the patient's restorations are still intact and esthetically pleasing (Figs 11 to 12b).

I would like to thank Dr Pier Francesco Graziani for his assistance in reviewing this article.

A literature list is available from the editors on request

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A good option for the lifelike recreation of gingival tissue

Esthetic composite layering of implant-supported restorations in an edentulous jaw

Dr Patrice Margossian, Marseille, and Pierre Andrieu, Aix-en-Provence/France

The flawless reconstruction of gingival tissue requires sound teamwork as well as excellent materials and exceptional skill. Layering with the light-curing laboratory composite SR Nexco takes this procedure to a new level.

Careful planning is indispensable in the treatment of an edentulous jaw with implant-supported restorations. The axes and positions of the implants must correspond to the given biological, mechanical and esthetic conditions. In situations where severe bone recession has occurred, the work of the dental team will involve not only the reconstruction of dental but also of gingival tissue. The dentogingival complex must primarily fulfil two aspects: function (chewing and speaking) and esthetics (alignment of the teeth and gums and lip support).

Fig. 1: Initial portrait of the patient

Fig. 2: Extremely poor oral condition: The teeth could not be rescued. The jaw ridge in the upper jaw was considerably atrophied.

Clinical case presentation

When the 37-year-old female patient presented to our practice her teeth and the related bone structure were in very poor condition (Figs 1 and 2). Numerous teeth were missing in both the upper and lower jaw. Furthermore, the upper jaw showed considerable bone and gingival resorption. The patient wished to have fixed teeth again and regain an attractive appearance. Due to the extensive damage that had occurred, the complete restoration of both jaws with implants was indicated.

Surgical phase

As a result of sufficient bone structure in the lower jaw, this part of the mouth could be restored at once with four immediately loadable implants. During the reconstructive phase, the upper jaw had to be treated with a provisional removable denture due to the atrophied jaw ridge. The tooth extractions in the upper and lower jaw took place on one day. At the same time, the four lower jaw implants were inserted and loaded. An immediate denture was placed in the upper jaw.

During the osseointegration period of the mandibular implants, the bones in the upper jaw were reconstructed. The maxillary sinus and the jaw ridge were augmented in one appointment. At the next appointment, ten implants were placed according to the treatment plan. Six months after this intervention, the implants were exposed. As a result of a well-planned soft tissue management strategy, firm keratinized tissue had formed in adequate form. The permanent restorations for the upper and lower jaw were fabricated two months later (Figs 3 and 4).

When the upper and lower jaw have to be restored, it is important to start with the upper jaw. Alternatively, both jaws can be restored simultaneously.

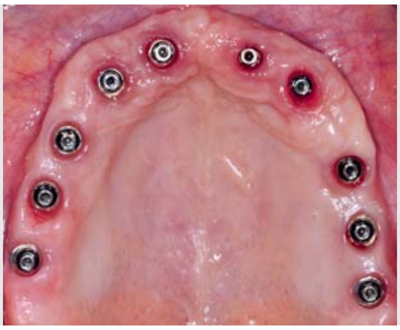


Fig. 3: After bone augmentation measures had taken place, ten implants were inserted. The picture shows the situation prior to the prosthetic phase.

Fig. 4: Four implants were inserted in the lower jaw. Bone augmentation measures were not necessary in this case.

Prosthetic phase

The determination of the occlusal plane and the ideal incisal line allows the tooth arches to be integrated more easily in terms of esthetics and function.

Impression taking

Open tray impressions were taken with a special plaster (Snow White) and unsplinted impression posts. The considerable stiffness of the impression material completely immobilized the impression posts, which prevented any errors from occurring in the casting of the study models.

Articulation of the models

The articulator allows the kinematics of the jaw to be correctly simulated. The aim of this part of the treatment is of a functional nature. It is intended to ensure the optimal occlusal integration of the restorations and the proper jaw movements during chewing, speaking and swallowing. In this particular case, the upper jaw model was positioned with the help of a facebow. Four impression posts were screwed on the implants in order to provide strong support and enhanced reliability. Alternatively, this step can take place directly on the immediately loaded provisional restorations. For this purpose, however, the model has to be mounted in the articulator of the dental practice. In the present case, the masticatory model was positioned in the correct relation to the hinge axis-orbital plane.

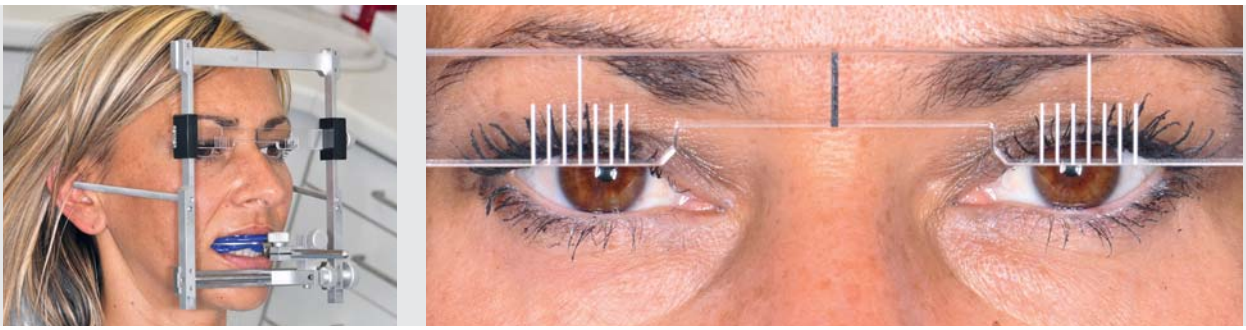
Subsequently, we adjusted the bite patterns in order to record the vertical dimension of occlusion. The centric relationship is regarded as the reference position for adjusting the muscles to the centric and functional jaw relationship. The mandibular model was mounted in the articulator with the help of an antagonist jaw relationship record. If the centric and the vertical dimension of occlusion are correct, the immediately loaded provisional restorations can be used for this purpose. The restorations have to be immobilized when they are mounted in the articulator. The Artex system allows the articulator of the dental practice and that of the laboratory to be synchronized.

Recording of the major facial criteria

The Ditramax® system was used to transfer the precise data related to the esthetic facial axes to the maxillary model (Figs 5a and b). Two axes were marked on the plaster base of the model (vertical and horizontal). The vertical axis represents the sagittal median plane. From the front, the horizontal axis is aligned parallel to the bipupillary line and from the side to Camper's plane. These markings, which should be very close to the working area, act as a guide for the dental technician in setting up the teeth. Therefore, the incisal line has a predictable parallel alignment to the bipupillary line. The incisal axis is aligned parallel with the sagittal/median plane. The Camper's plane markings indicate the alignment of the occlusal plane. All these elements provide a sound rationale for the tooth set-up according to esthetic and functional principles.

Tooth selection and set-up

We selected the tooth shade and the teeth on the basis of the SR Phonares® II tooth mould chart. Holding the teeth up against the lips of the patient quickly reveals whether or not they are in harmony with the facial features. The set-up of the



Figs 5a and b: Recording of the esthetic facial axes with the Ditramax system

Fig. 6: The denture was set up with pre-fabricated teeth (SR Phonares II).

Fig. 7: Try-in of the CAD/CAM-fabricated titanium framework in the upper jaw

Fig. 8: The ground down composite resin areas were conditioned for receiving the light-curing laboratory composite SR Nexco.

Fig. 9: Application of the colour saturated intensive Gingiva materials (SR Nexco® Paste Intensive Gingiva)

Fig. 10: The application of various translucent materials imparted the prosthetic gingiva with the desired depth effects.

Fig. 11: Lifelike, vital, esthetic – the white and pink esthetics have been optimally imitated.

teeth according to the Ditramax markings (Fig. 6) allows the situation to be clinically validated. In this case, particular attention was given to the esthetic integration of the dentogingival complex when the patient was smiling. The lip dynamics were shown with video clips. The functional criteria were also checked. The vertical dimension of occlusion had to be harmonious in order to achieve a balanced lower facial third and proper phonation.

Fabrication of the framework

We felt that a CAD/CAM-fabricated titanium framework (e.g. Procera® from Nobel Biocare) would best fulfil this indication. The double scan technique allowed the implant model to be superimposed on the tooth set-up to construct the framework. In the next step, the framework was machined and then tried on the model and in the patient's mouth (Fig. 7). The cast impression and the high-performance processing systems significantly contributed to ensuring the optimal passive (tension-free) fit of the framework, which is decisive for the long-term success of the restoration.

Preparation of the framework for veneering

The areas that needed to be built up with Gingiva materials were blasted with aluminium oxide using 2 to 3 bar pressure. Subsequently, the SR Link bonding agent was applied, followed by a thin layer of the light-curing SR Nexco® Gingiva Opaquer to mask the metal framework. The opaquer was polymerized and then a second coating was applied and polymerized. The resulting inhibition layer was removed. The conventional flask technique with a heat-curing denture base material (ProBase® hot) was used to produce the denture. After the polymerization process, the denture base was ground and space was made for building up the Gingiva composite. The surface was conditioned by blasting it with aluminium oxide (50 µm) at 2 bar (Fig. 8). Then, a bonding agent was applied, which was left to react for three minutes before it was light cured.

Veneering of the gingival areas

In order to achieve very lifelike results in the layering of the gingival tissue, saturated (intensive) materials were used first (SR Nexco Paste Intensive Gingiva) (Fig. 9). Next, translucent,

Fig. 12: The restorations on the implants in the upper and lower jaw

Fig. 13: Close-up view: The macro- and microstructure of the teeth and the characteristic play of colour of the gingiva is clearly visible.

Fig. 14: The complex restoration gave the patient a new lease on life.

light-curing Gingiva materials (SR Nexco Paste Gingiva, SR Nexco Paste Basic Gingiva) were used to impart the gingival areas with the desired depth (Fig. 10). The colours of the Gingiva composites range from pale pink to reddish and orange and purple. A certain learning curve is necessary to master the necessary mixing techniques and achieve a harmonious interplay of the intensive and the translucent materials. Practice is essential and it will pay off. With some technical skill, the gingival areas can be naturally reproduced in shape, texture and shade.

All the individual layers were precured (Quick) in segments. A high-performance curing light was used for the final polymerization. Prior to this step, a coating of glycerine gel (SR Gel) was applied to the surfaces to prevent oxygen inhibition, which could lead to an unattractive and difficult-to-polish result. The surfaces of the teeth were characterized with a vertical and horizontal macrostructure. Particular attention was paid to mechanical polishing. Once the glycerine gel was removed, the restorations were finished with different polishing instruments (various grit sizes, pumice, leather buffing wheels and universal polishing paste) (Fig. 11). In the present case, mechanical polishing was preferred to glazing with light-curing composite in order to prevent premature ageing of the surface.

Attachment of the permanent dental restorations

The dentures were inserted manually with the help of multi-unit abutments from Nobel Biocare (Fig. 12). The screw channels were sealed with Teflon and light-curing composite resin. The position of maximum intercuspation was checked and the occlusal pathways were adjusted to the protrusive and laterotrusive movements. In addition, the restorations were checked in terms of the ability to clean them with interdental brushes, and the patient was given special instructions regarding her oral hygiene.

Discussion

For a long time, ceramics were considered to be the esthetic benchmark. With the introduction of state-of-the-art industrially fabricated acrylic teeth, which are specially designed for implant applications, the bar for esthetics has been raised in this category of materials. The teeth used in this case exhibit a true-to-nature morphology, which allows the restoration to be functionally integrated without any problems. Using the laboratory composite SR Nexco to recreate gingival tissue is a good restorative approach. In contrast to ceramic materials, the composite resin is easy to handle and delivers exceptionally esthetic results (Fig. 13). The light weight of the material is an added bonus. An all-ceramic restoration (zirconium oxide framework, layering ceramic, gingival mask) weighs almost twice as much as a titanium-composite resin denture. Another advantage of the type of restoration described here is its long service life.

Conclusion

The success of an implant-retained denture depends on the systematic coordination of all the surgical and prosthetic requirements. A strict procedure needs to be followed from the treatment plan to the final outcome. Layering gingival portions with a laboratory composite represents a genuine improvement on previous materials and methods with regard to esthetics, handling and hygiene (Fig. 14).

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Technology meets craftsmanship

Prosthetic implant restoration of an edentulous upper jaw using zirconium oxide

Dr Dario Žujić, DT Velimir Žujić, both Rijeka/Croatia, and DT Dragan Stolica, Maribor/Slovenia

Many edentulous patients wish to have their oral functions re-established with a fixed esthetic restoration. We can meet this request by combining implantology with dental CAD/CAM technology.

Full-arch implant-supported superstructures can be achieved by various methods. Depending on the bone quality and number of implants, the patient may either receive a fixed or removable implant restoration. If a fixed prosthesis is indicated, the superstructure may either be cemented or, alternatively, screwed directly to the implant fixture, depending on the clinical situation. In the case described here, we opted for a cemented zirconium oxide bridge. Monolithic crowns were used in the posterior region. For the anterior region, the crowns were cut back and veneered. Translucent zirconium oxide (Zenostar® T, Wieland Dental) was utilized for the framework and IPS® e.max Ceram for the veneering of the anteriors. These materials allowed the desired strength and esthetics to be achieved.

Preoperative situation

When the patient came to our dental lab, she wore a classic full-arch denture in her upper jaw. She was unhappy about the esthetic appearance, functional qualities and the loose fit of the denture. Her oral condition was assessed with digital volume tomography (DVT) to confirm that adequate bone quantity was available to facilitate the anchorage of the implants. Although the placement of four implants would have provided adequate stability for a removable denture, the patient desired a fixed all-ceramic reconstruction. Having discussed the treatment options with her, we abandoned the idea of providing an implant-supported denture based on the "All-on-4" concept and instead chose to manufacture a fixed, implant-retained bridge. The framework would be made of zirconium oxide and the anterior teeth would be individually veneered.

Implant treatment and healing phase

On the basis of the DVT examination, seven implants (Replace CC, Nobel Biocare) were planned and placed. An adequate primary stability of 30 to 35 Ncm was achieved. During the healing phase, the patient wore the existing denture that had been relined with soft silicone. After a six-month healing period, a satisfactory level of osseointegration was achieved, without any signs of bone resorption or inflammation. The implants were uncovered and gingiva formers inserted. Two weeks later, an impression was taken to transfer the position of the implants to the dental lab. After model fabrication, appropriate abutments were selected and adapted to achieve a common insert direction for the bridge (Fig. 1).

> A long-term temporary bridge was placed to help assess the functional and esthetic requirements that needed to be met to ensure the clinical success of the final restoration.

Digital technology was employed to manufacture the temporary bridge. The model was scanned using a Zenotec® D800 lab scanner (Wieland Dental) and the temporary bridge designed with the 3shape dental design software. Milling was carried out in a Zenotec select S2 milling unit (Wieland Dental) using a PMMA material (Telio® CAD).

Framework fabrication

As the patient was satisfied with the shape and function of the temporary restoration, we used it as the basis for the design of the final restoration. The natural wear facets that formed during the temporization period should be reflected in the final restoration. A conventional impression of the oral situation was taken in the practice. In the lab, a model and a gingival mask were prepared and scanned. First, the working model together with the temporary bridge was digitized. Next, we scanned the model together with the abutments, the opposing jaw model and the bite registration. Finally, the abutments were scanned individually one after the other because the abutment shoulders were located subgingivally and could therefore not be captured accurately enough with the model scan alone (Figs 2a and b).

CAD construction

First, the position of the digitized model was defined in the design software according to the common insert direction of the abutments. In the second step, the shoulder lines of the abutments were marked and the thickness of the cement gap was defined. The shoulder line represents the "preparation margin" of the restoration. In this case, we set the cement gap to 0.2 mm and the cement space to 0.4 mm. The thickness of the cement gap at the marginal border was set to 0.1 mm. In our experience, these settings result in an excellent accuracy of fit of the restoration on the model and in the patient's mouth, eliminating the need for later adjustments. At the end, the design of the restoration was checked once more against the individual design parameters. If the wall thickness is lower than the minimum acceptable, the software will issue a warning and enable an automated remediation step.

The final restoration was designed using the full-contour long-term temporary as a basis. The full contours of teeth 13 to 23 were reduced by 0.9 mm on the vestibular aspect to make space for the partial veneers (Figs 3a and b). The incisal border was left fully contoured as a large number of functional movements occur in this area. The fully contoured shapes of the posterior teeth and the palatal surfaces of the anterior teeth were left unaltered to ensure a maximum level of strength in the final restoration. There was a risk that the abutments might shimmer through as grey areas. For this reason, we decided to use translucent zirconium oxide. The layer thickness appeared to be adequate to mask the abutments.

Milling

The completed CAD design divides a basic crown framework into 18,000 to 20,000 coordinates and generates a harmonious surface texture and perfect marginal seal. The completed design was transferred to the CAM unit. We use the V3 CAM version, which gives us the option to choose between various output formats. The Zenocam® 3.2 format is our preferred output option because, in contrast to the open STL format, it delivers information on the specified cement gap, implant axes and restoration margins. The CAM software uses this information to calculate milling parameters that distinguish between the different areas of the restoration. For instance, when milling the restoration margins, the unit reduces the speed, infeed and feed rate to prevent thin crown margins from breaking or fracturing. As a result, even wafer-thin cervical margins having a thickness of as little as 0.1 mm can be reliably milled and require only very little reworking after the sintering process. In less sensitive areas, the unit uses a higher milling speed. After the output format has been entered, the milling strategy is chosen. In this case, a milling strategy using 2.5 mm, 1.0 mm and 0.7 mm burs was selected for the manufacture of the bridge. The option of using a 0.3 mm bur was not taken as it was not needed for the restoration in question.

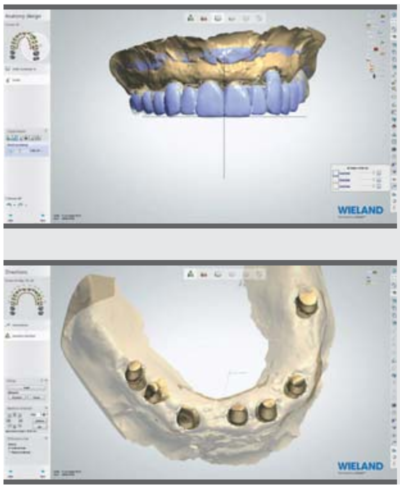
Next, the job was placed in a virtual Zenostar® blank (Fig. 4). We decided to use a translucent, pre-shaded Zenostar T zirconium oxide disc in the shade T sun, because the posterior teeth from 14 to 16 and 24 to 26 were planned to be restored with monolithic zirconium oxide. The warm, reddish shade of this disc closely matches the selected tooth shade and allows the A – D shades to be recreated efficiently and reproducibly. Next, a sinter support structure was designed to allow the restoration to be sintered in an upright position in the Programat® S1 sintering furnace. The sinter frame minimizes distortion during sintering and is instrumental in achieving a high accuracy of fit in long-span objects. Finally, the program calculated the milling data in a process that took less than three minutes to finish.

Then, the milling operation was started. This process was achieved in a Zenotec select S2 milling unit that features 5-axis operation and an 8-disc material changer (Wieland Dental). The absolute precision with which this unit works is evident in the excellent milling results obtained on the occlusal and palatal surfaces and at the incisal edge (Fig. 5).

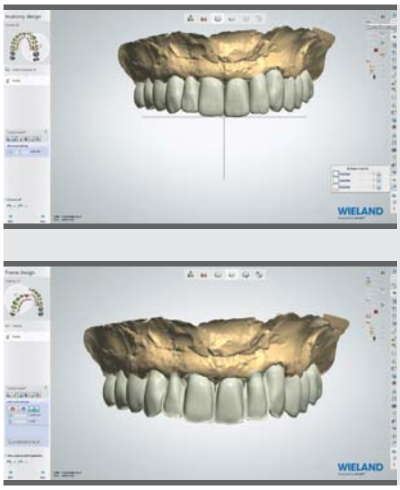
Customizing the framework

Once the milling was completed, the framework and the sinter support structure were separated from the disc. At the next step, the unsintered bridge was customized with colouring liquids using the infiltration technique. The range of Zenostar Color Zr liquids is perfectly suited for this purpose. These liquids are supplied in

Fig. 1: The seven implants in the edentulous jaw were to be connected to a fixed bridge made of zirconium oxide.



Figs 2a and b: Digitized model with temporary restorations (above) and abutments (below)



Figs 3a and b: First, the restoration was designed in full contour and then cut back in the visible esthetic region.

Fig. 4: Nesting of the bridge framework in the CAM software

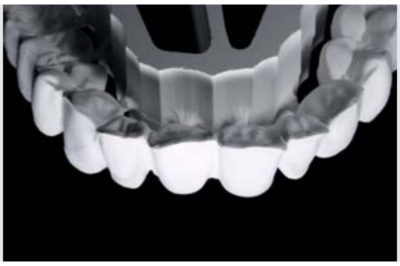


Fig. 5: After milling: high precision result with excellent marginal accuracy (incisal, occlusal)

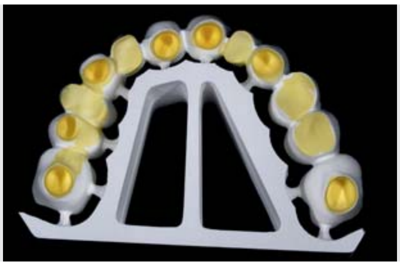


Fig. 6: Shading the interior crown surfaces and basal surfaces

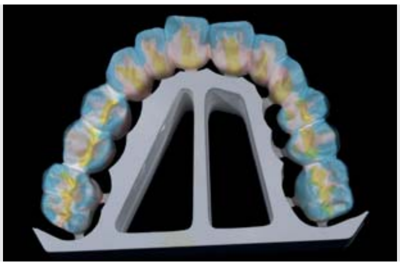


Fig. 7: Customized framework prior to sintering

the standard shades of the A – D shade guide. Additionally, five Effect shades are available for further customizations. We used Zenostar Color Zr in shades A2 and A3 as well as the grey-violet Effect shade. To render the infiltration of the individual liquids visible, the virtually colourless liquids were mixed with a visualizer (Zenostar VisualiZr). First, the interior surfaces of the crowns and the basal surface were infiltrated; followed by approx. 1 mm of the cervical margin, the fissures and the central areas of the palatal surfaces. Infiltration of all these aspects was achieved with Zenostar Color Zr A3 mixed with yellow Zenostar VisualiZr (Fig. 6). After that, the dentin area up to the incisal third was infiltrated with shade A2 mixed with red VisualiZr liquid. The incisal area of the anterior teeth and the cusps of the posteriors were customized with a diluted version of grey-violet Effect shade and Zenotec Color Optimizer mixed with blue VisualiZr liquid (Fig. 7). It is essential to use a separate brush for each shade. After having been allowed to dry for two hours, the framework was sintered in a Programat S1 sintering furnace.

After the sintering process, the restoration exhibited an excellent accuracy of fit, without necessitating any adjustments by grinding, e.g. on the insides of the crowns. The advantages of the translucent zirconium oxide used were obvious at this stage. Due to the colouring liquids, the cervical and dentin areas were beautifully accentuated. The incisal areas exhibited a slight greyish-translucent sheen, which should facilitate the subsequent layering procedure. Figure 8 shows the smooth transition of the shades. The simulation in Figure 9 demonstrates how difficult it would have been for us to achieve the desired tooth shade if we had used opaque white zirconium oxide for the framework. Despite the high translucency of the zirconium oxide, the titanium abutments do not show through the framework.

Individual framework refinements

An optimum esthetic outcome is only achieved if the restoration exhibits ideal optical properties. A controlled brightness value, adequate saturation and translucency and minimized light reflection are essential to achieve a pleasing esthetic outcome. If these parameters are not met, the result will never be satisfactory, even if the restoration is veneered with ceramics. The result would simply be a restoration that looks good on the model but appears too bright in the mouth.

Anterior area

Staining the zirconium oxide prior to sintering is the first measure to control the light reflection effects. Application of a liner is the second measure. The bridge was veneered with IPS® e.max Ceram. As the framework already exhibited a pleasing basic shade, we applied a mixture of IPS e.max Ceram ZirLiner Clear and Incisal (70:30). ZirLiner Incisal reduces the

Fig. 8: After sintering: smooth colour transition and ideal basic shade for completing the bridge

Fig. 9: Comparison between white opaque zirconium oxide (superimposed simulation at the top margin) and the Zenostar Zr framework

Fig. 10: After the liner and foundation firing…

Fig. 11: ... the vestibular anterior surfaces were veneered individually.

Fig. 12: After final firing: the monolithic crowns did not appear brighter than the veneered crowns.

Fig. 13: Finished bridge: harmonious shade effects and homogeneous surface texture


Figs 14 and 15: The cemented bridge pleases with its beautiful natural appearances and meets the patient's functional and esthetic expectations.

light reflection of zirconium oxide; alternatively Liner 4 may be used. To mix the liners, IPS e.max ZirLiner Build-Up Liquid was added. The result was a mixture with a pleasing consistency, ensuring an even coating. After the firing process, the restoration exhibited a homogeneous surface and an adequate level of fluorescence.

For the foundation firing of large restorations, we prefer the layering technique rather than the sprinkle technique. The layering technique provides better adhesion and optical effects (wash firing: Deep Dentin A2, A1, DA2, A1 and T-Neutral) (Fig. 10). The individual vestibular surfaces can be easily veneered. The tooth shape was given and the framework was used as the basic shade (veneering: Dentin A2, A1, T-Neutral, OE1, OE2, I1) (Fig. 11). After the firing process was completed, the value, saturation and light reflection effects looked as desired. The shade effect of the restoration is identical in intensive light, in normal light and in the shade and matches the chosen A – D tooth shade.

Glazing the monolithic areas

Shade characterizations (Shades, Stains) are applied to the monolithic portions before dentin firing. We continued to apply thin "soft" coatings of colour and used IPS e.max Glaze Fluo for the glaze firing process.

Finishing the restoration

After the final firing, the restoration exhibited harmonious shade effects. The bridge satisfied all functional and esthetic criteria. The monolithic portions did not appear brighter than the veneered parts (Fig. 12). Finally, we polished the bridge and ensured that the conditions for optimum oral hygiene were in place. Smooth surfaces are essential to prevent the excellent biocompatibility of zirconium oxide from being diminished and undesirable wear from occurring in the opposing jaw. After a final check, the restoration was forwarded to the dental practice (Fig. 13).

Direct link to the tablet version:

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

Conclusion

After the preparations were completed, the bridge was cemented in place. The ceramic restoration looks three-dimensional. Even without layering, the posterior teeth demonstrate a natural colour depth. With their vibrant internal shade effects and lifelike warm translucency, the anterior teeth demonstrate impressive esthetic properties (Fig. 14). The combination of cutting-edge milling technology and high-quality veneering ceramics provides an efficient route to achieving esthetically pleasing, reliable and long-lasting treatment results. The goal of the prosthetic treatment team is to see a happy patient with a beautiful natural smile (Fig. 15)!

I would like to thank my assistants for their help.

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Together towards pink-white esthetics

Communication is the foundation for natural-looking results

Dr Jorge André Cardoso, Espinho, DT Oleg Blashkiv, Porto, Dr Rui Negrão, Porto, and Dr Teresa Taveira, Espinho/Portugal

"Communication is the answer to complexity." This article demonstrates, once again, the importance of good cooperation between the dentist and the dental technician.

In prosthetic dentistry, effective communication between the clinician and dental technician is of paramount importance. This article presents a case which, among other things, involved soft-tissue remodelling in the anterior region. Consistent close cooperation between the dentist and the dental technician and their concerted action provided the basis for a successful outcome.

Case presentation

A 32-year-old female patient presented to our practice with an unsightly, defective anterior bridge extending from tooth 12 to tooth 21. The bridge had been placed seven years previously. As she was unsatisfied with her smile, the patient was looking for an esthetic, more natural-looking alternative. The veneer of the metal-ceramic bridge had a very opaque and yellowish appearance. In tooth 21, the metal margin was exposed cervically due to gingival recession. Alveolar ridge atrophy in the area of the missing right central incisor (pontic) had resulted in a considerable vertical reduction. The shape and shade of the teeth needed improvement and harmony between white and pink tissues had to be restored (Fig. 1).

Treatment plan and mock-up

Since smile improvements involve complex procedures, it is advisable to simulate the final result by means of a direct composite mock-up. This important step enhances the trust and confidence of the patient.

Fig. 1: Initial situation

> The mock-up provides an optimum basis for discussing a case and promotes the emotional connection with the treatment team.

A mock-up provides the patient with a clear idea of what the effect of the planned restoration will be once it has been seated in the mouth. In our opinion, this step cannot be entirely replaced by digital design previews. The mock-up allows the lab technician to obtain a better understanding of the individual clinical situation. Later on, the mock-up can be used as a template in the fabrication of the lab wax-up and/or the provisional restoration.

In the case at hand, the mock-up revealed that in order to achieve a more balanced appearance, tooth 22 needed to be integrated into the restoration (Fig. 2). And even more importantly: it showed that not only the correct position, shape and colour of the teeth were key factors in achieving a harmonious smile in this case, but also the correct gingival architecture and emergence profiles. Consequently, the patient was informed that, in order to achieve a satisfactory result, the soft tissue volume had to be increased in the pontic area. The patient fully agreed to the treatment plan suggested.

The treatment plan involved:
1. the removal of the existing restoration
2. the placement of a provisional bridge and soft tissue grafting in the pontic area (soft tissue management that would take several months)
3. the insertion of a new ceramic bridge and a laminate veneer on tooth 22 and, if needed, also on tooth 13.

Fig. 2: Simulation of the desired result by means of a direct mock-up

Figs 3a and b: Soft tissue management with the help of the provisional restoration after the first connective tissue graft

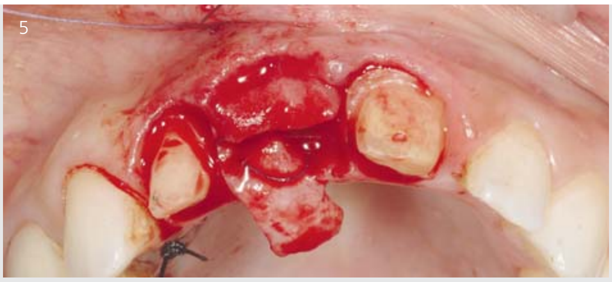
Figs 4a to c: The result after the first soft tissue graft

Connective tissue graft and immediate provisional bridge

Very frequently, tooth extraction can be established as the possible cause of alveolar ridge atrophy. In this particular case, there was a considerable lack of volume due to bone loss in the pontic area. To re-establish the soft-tissue architecture, two surgical interventions were planned. Immediately after having performed the first connective tissue graft, a provisional, lab-fabricated bridge was placed. The bridge was constructed on the basis of the mock-up information. It was reinforced with metal wire. The soft tissue contouring phase that followed took several months. Initially, the provisional exhibited an inner concave surface to provide sufficient space for the soft tissue. Some authors suggest that the provisional pontic should have the final convex shape. However, having a concave initial shape allows for progressive tissue modelling from the palatal to the buccal side, which is helpful especially when several grafts are needed (Figs 3a to 6d).

Communication of emergence profiles and shapes to the lab

Once the desired soft tissue shape has been achieved, one of the great challenges is to transmit all the relevant information, especially the length of the inter-incisal papillae and the



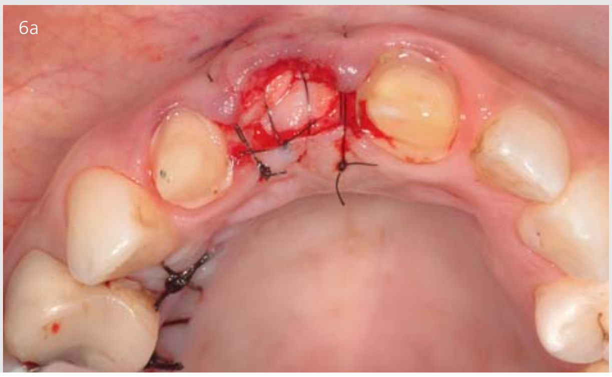
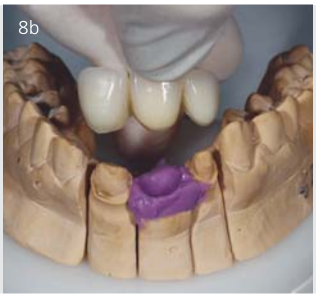


Fig. 5:
Second connective tissue graft

Figs 6a to d:
After the surgical intervention, a metal-reinforced provisional was placed and the shape of the pontic area was progressively shaped from concave to convex during the following months.

Fig. 7:
Try-in of the zirconia
bridge framework



Figs 8a and b:
Lab communication: Transfer
of the basal shape of the pontic
from the mouth to the model

pontic shape, to the dental lab. This is important because when the impression is made, the pressure of the impression material may deform the soft tissue. In order to prevent any possible loss of information, the pontic area of the provisional restoration was filled with a silicone-based impression material and then placed over the prepared teeth on the model (Figs 7 and 8). This would provide the technician with a good approximation of the final shape of the pontic.

In order to determine the correct location of the contact point, the distance between the bone crest and the gingival crest was measured. It is well-established in the literature that a papilla will be present if the contact point is no more than 6.5 mm away from the most coronal interproximal height of the bone crest between a natural tooth and a pontic. This can be measured by probing the bone with an endodontic spreader, marking the distance during the ceramic try-in and then using

Fig. 9: Lab communication: Gingiva contours, interproximal stains, the position of the buccal ridges, etc. were communicated by means of slide share software.

Fig. 10: The final restorations on the model. Bridge on teeth 12 to 21, veneer on tooth 22

Figs 11a to c: Cementation of the ceramic restorations

Figs 12a and b:
Lateral view of the inclined final restorations

Fig. 13:
Frontal view

it in the fabrication of the restoration. However, using this distance can lead to a very large contact area with a short papilla if the bone is missing. The result is an unnatural, square tooth shape. Therefore, this is important information for the dental technician. When applied wisely during ceramic layering, interproximal pink, brown and yellow stains can create a very natural illusion and thus help to overcome this problem. In the course of the treatment in this case, it became clear that the restoration of tooth 13 was unnecessary to achieve the desired outcome.

The try-in of the restoration revealed that the zeniths of the gingival contours were misplaced. The use of slide share software (e.g. Keynote) allowed us to transmit visual information to the dental technician on the following issues:
- the desired gingival zenith
- the desired interproximal stains
  (to mask the interproximal spaces)
- the position of the buccal ridges, which is of paramount importance for the visual perception (Fig. 9)

Final restorations

Even though cementing the veneers first has certain advantages (colour stabilization), in this particular case both types of restorations were cemented simultaneously. The veneer for tooth 22 was pressed from IPS e.max® Press lithium disilicate glass-ceramic (shade LT, A2) and completed with IPS e.max Ceram. The pressable ceramic is available in various degrees of opacity and enables esthetic restorations to be fabricated that blend seamlessly with the remaining dentition. Variolink® Esthetic LC, a light-curing luting composite (in a neutral shade), was used to cement the laminate veneer (Figs 10 to 13). The porcelain-fused-to-zirconia bridge (IPS e.max ZirCAD veneered with IPS e.max Ceram) was cemented with the self-adhesive, self-curing resin cement SpeedCEM® (in shade Transparent) according to the instructions of the manufacturer.

Conclusion

Smile improvements are very challenging, particularly if, in addition to restoring the white esthetics, a harmonization of the gingival architecture is required. Only by choosing a multidisciplinary treatment approach will mutually beneficial communication between the dentist and dental technician take place. This is an essential prerequisite to achieve the desired success.

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