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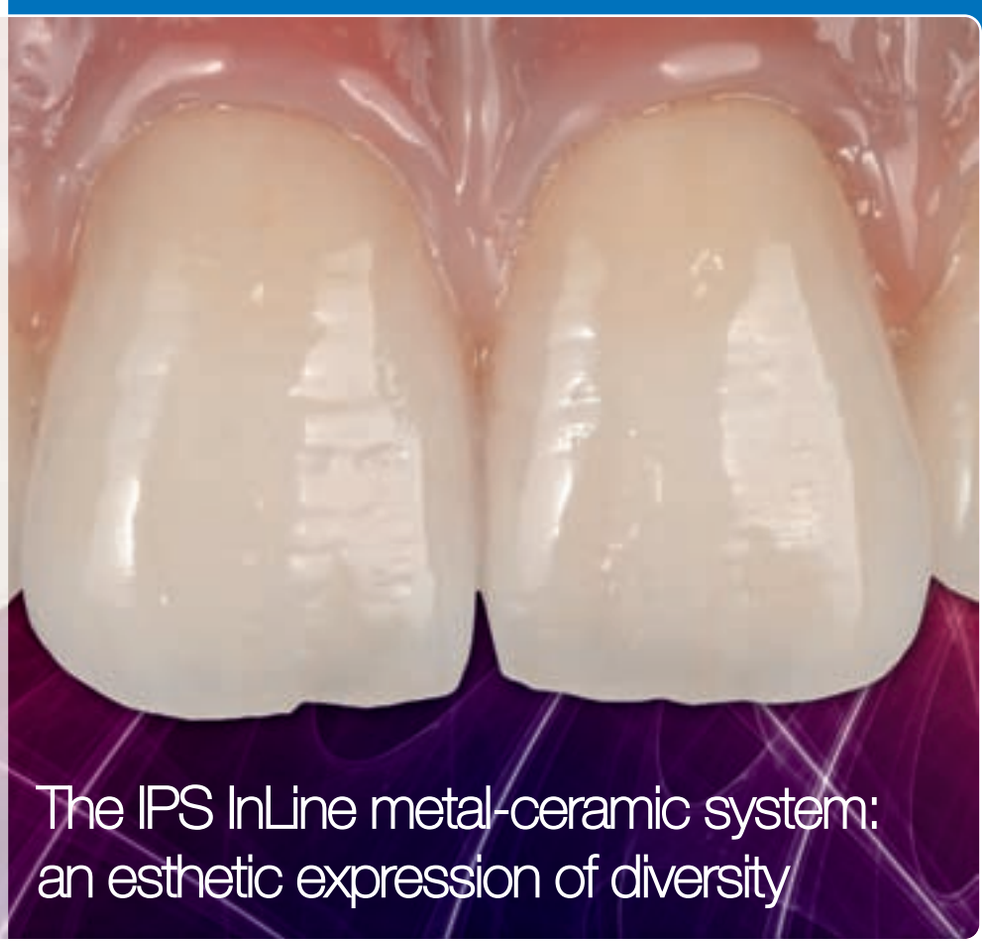

The IPS InLine metal-ceramic system: an esthetic expression of diversity

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IPS InLine One: a new way in ceramics, or only just a dream?

One ceramic, one layer, one solution

A field report by Velimir Žujic, Rijeka/Croatia

Ceramic technicians are a special breed among dental technicians. The ceramics room is often the most beautiful one in the laboratory and it typifies all that which the ceramist has made his/her business: to create perfect tooth reproductions with the help of umpteen jars and layers, sometimes using irreproducible methods. Velimir Žujic is such a ceramics specialist. Here, however, he shows that it is also possible to create esthetic dental restorations with only one ceramic material.

Keywords

- Metal-ceramic crowns and bridges
- Layering pattern
- Economic efficiency

Type

Product-related user report

Introduction

As an old-school ceramist, I learned the layering technique from the best ceramists in the world over many years. The manufacturers of veneering ceramics have supported this technique with more and more materials for internal characterization. In a time in which CAD/CAM units are becoming increasingly important and the fear is rising that our profession will be made obsolete by machines in the future, we are spending more and more time on complex layered metal-ceramic crowns. This is our way of proving that the work fabricated by humans is irreplaceable and cannot be reproduced by machines. Therefore, I was extremely sceptical when I first heard about IPS InLine One. And I was far from pleased that my beloved Mamelon, Opal, Effect, Transpa and Dentin materials were replaced by only seven Dentcisal layering materials for the fabrication of ceramic veneers in this technique.

Then again, I found the concept of a single and economic processing method, which shortens the fabrication time of a single crown, to be very appealing.

For a user of IPS InLine who works with all the Opaquers, Stains and Shades, the limited investment costs for the seven Dentcisal materials are justifiable. IPS InLine One is a new product line within the IPS InLine metal-ceramic system. With this system, various cross-system components (such as Opaquers, Shades, Stains, Glaze) can be used for the conventional layering technique (with IPS InLine), the press technique (with InLine PoM), as well as for the one-layer technique (IPS InLine One). The resulting wealth of application options renders the metal-ceramic material particularly cost-effective for me. IPS InLine One is a one-layer metal-ceramic and the latest extension of the comprehensive IPS InLine system. Merely the Dentcisal veneering ceramic is necessary for the quick and uncomplicated fabrication of an esthetic restoration.

First experiences/the case

In this article, I would like to describe my first experiences with IPS InLine One. The case was just an "everyday" case. The female patient wanted the complete reconstruction of her upper tooth arch shortly before her vacation. The restoration had to be made of ceramic and in just a few days. The patient had an old metal-ceramic bridge in the anterior region and a removable partial denture in the posterior region. Fortunately, the eight remaining abutment teeth were sufficient to restore the maxilla with a metal-ceramic reconstruction.

I like to rely on proven systems that consist of components coordinated and recommended by the manufacturer. For this reason, the metal framework was fabricated of the Colado CC cobalt-chromium alloy. Given the higher modulus of elasticity and proof stress of base metal alloys, the framework can be given a very delicate design with Colado CC. Nevertheless, the substructure was designed in a reduced tooth shape to ensure the even thickness of the veneering ceramic layer (Figs 1 and 2). Only in this way can weak areas be prevented and the ceramic restoration made durable enough to withstand the masticatory forces.

Even though oxide firing is not imperative, I fired the restoration once to remove any possible contamination on the alloy surface.

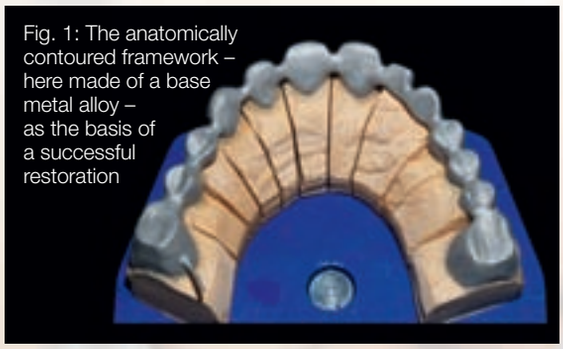


Fig. 1: The anatomically contoured framework – here made of a base metal alloy – as the basis of a successful restoration

Fig 3: A thin layer of opaquer is applied for wash firing.

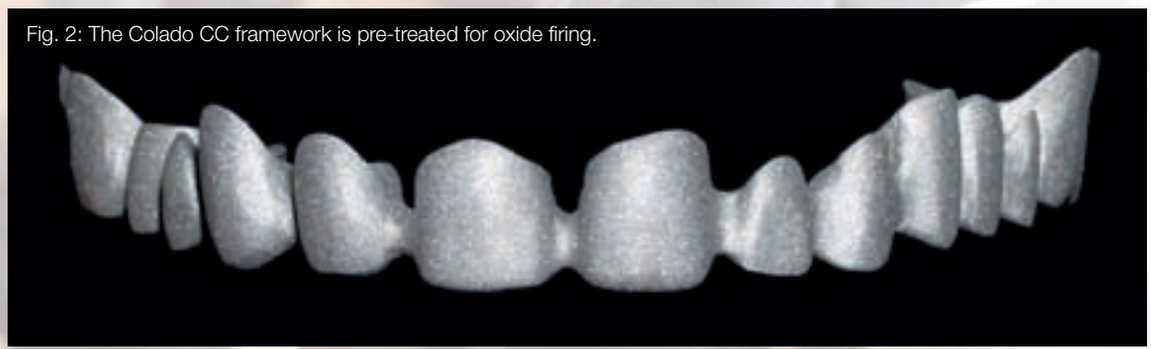


Fig. 2: The Colado CC framework is pre-treated for oxide firing.

After that, the framework was cleaned with steam and dried. Subsequently, the first thin opaquer layer was applied (Fig. 3) and fired (930 °C/1706 °F, holding time 2 min.). The greyish colour of the framework was completely masked with the second opaquer layer. It was fired using the same parameters. To improve the lifelike appearance (particularly in the cervical area, where the ceramic layer is very thin), I mixed the standard A2 opaquer with 20 percent InLine Opaquer F (fluorescence) (Fig. 4).

Shade selection

The desired tooth shade can be easily assigned to the 7 Dentcisal shades with the help of the clearly arranged material combination table in order to achieve the desired A-D shade (Table 1).

Since A2 was determined as the tooth shade, I layered the entire veneer with Dentcisal 2 (Fig. 5). Before firing, the Dentcisal material was separated in the interdental area to achieve controlled shrinkage (first Dentcisal firing: 910 °C/1670 °F, holding time 1 min.).

First firing

My first impression was one of amazement. After firing, the Dentcisal material demonstrated hardly any shrinkage. As a result, the entire layering procedure is highly efficient: It is straightforward and does not rely on many different characterization materials and shrinkage does not need to be compensated with several firing cycles.
Figure 6 clearly shows that only very little Dentcisal 2 material was required for the corrective firing (second Dentcisal firing: 900 °C/ 1652 °F, holding time 1 min.).

Second firing

Only minor adjustments were required after the second firing to achieve the desired shape to fulfil the esthetic requirements. In this process, I concentrated on the design of the proximal spaces, the position of the proximal contacts, as well as the tooth

Fig. 4: After the second opaquer firing, the metal framework is entirely masked, particularly at the cervical margins.

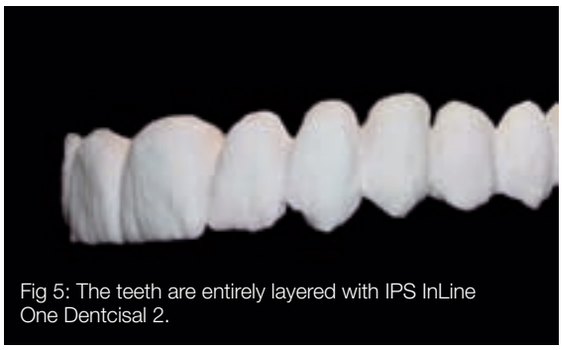


Fig 5: The teeth are entirely layered with IPS InLine One Dentcisal 2.

Fig 6: The limited shrinkage requires hardly any adjustment.

Fig. 7:
Try-in of the roughly fired restoration to check and monitor the treatment success – there is, in fact, chroma.

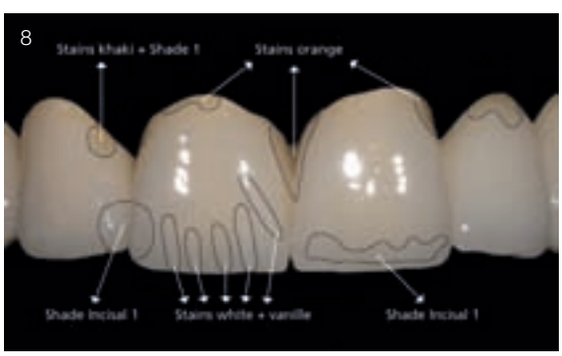


Fig. 8:
After the mechanical finish of the surface, the restoration is individualized with Stains and Shade Incisal materials.

Fig. 9:
Outstanding shade match after the final firing

axes and shapes. For the design of the incisal edges, I followed the contour of the lower lip. The shade effect of the work on the model is one thing; the effect in the oral cavity of the patient is something else entirely. I had reservations particularly with regard to the transparency. For that reason, the restoration was tried in after the second corrective firing. After all, a successful final restoration had to be ensured. And once again, I was positively surprised. The monochromatic layering with Dentcisal effectively masks the opaquer and the framework and shows sufficient chroma in the centre of the tooth (Fig. 7). If space is very limited, the application of a thin layer of Deep Dentin would be possible. However, this was not required in this case.

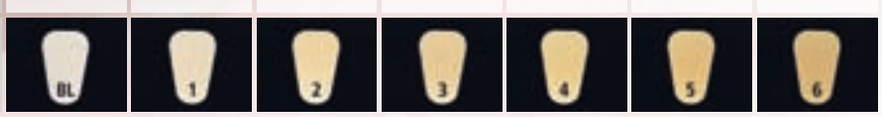
External characterization

Try-in provides an excellent impression about which Shade Incisal materials and Stains can and should be used. With the characterizations, the optical properties of natural teeth, such as light reflection and translucency, are imitated and the basic shade intensified in certain areas. Even though it is well known that these effects look more natural if they come from the inside of the restoration (as with natural teeth), very beautiful, lifelike results may be achieved by careful staining of the restoration surface. Once the surface texture of the veneers has been completed and the surfaces cleaned, I was able to commence the individualized characterization with IPS InLine System Shade and Stains material (Fig. 8). In this case, the individual characterizations were fired together with the glazing paste (Glaze/Characterization firing: 850 °C/1562 °F, holding time 1 min.).

Fig. 10: Palatal view of a detail with which the restoration can be characterized

Fig. 11: Lateral view of the result: The patient is highly satisfied.

Table 1: The shade combination table of IPS InLine is not only clearly arranged, it is also reduced to the essentials.

Opaquer A-D	BL1, BL2, BL3, BL4	A1, B1	A2, B2, C1, D2	A3, A3.5	B3, B4	C2, D3, D4	A4, C3, C4
Opaquer Chromascop		110, 120, 130, 140	210, 220, 230, 240	–	310, 320, 330, 340	410, 420, 430, 440	510, 520, 530, 540
Dentcisal							

The shade was checked after the last firing. As shown in Figure 9, the shade match, which has been created with only one monochromatic layering material, is excellent. Beautiful effects have also been achieved in the palatal areas (Fig. 10).

Figure 11 shows the lateral view of a completed restoration incorporated in the oral cavity. This restoration was completed in only a few days. My misgivings with regard to the esthetic effect of the IPS InLine one-layer ceramic were not confirmed. Quite the opposite really, I was pleasantly surprised.

My conclusion

Imitation, a major part of our profession, includes the reproduction and copying of a model, i.e. natural teeth. In order to determine the tooth shade, understand the material selection to imitate the desired shade, visually determine the suitable shape of the tooth arch and place the appropriate ridges or grooves, the ceramist must find inner peace, from which inspiration and energy can be drawn to re-create even the smallest detail in every single tooth. To find this inner peace and place for creativity, it is important to consciously create a free space – reading poetry or contemplating art may help in this endeavour. At the same time, these activities may inspire the creativity of dental technicians.

For me, IPS InLine One offers a possible way to create a little more time and free space in the hectic laboratory routine, find a healthy work-life balance and at the same time make patients happy with their new artificial teeth. ■

Product list

Product	Name	Manufacturer/ Distributor
One-layer veneering ceramic	IPS InLine One	Ivoclar Vivadent
Base metal alloy	Colado CC	Ivoclar Vivadent
Stains	IPS InLine System Shade and Stains	Ivoclar Vivadent
Veneering ceramic system	IPS InLine System	Ivoclar Vivadent

About the author

Velimir Žujić completed his education as a dental technician in Rijeka (Croatia) in 1977. Until 1980, he worked in the department for fixed denture prosthetics in the centre for dental medicine of Murska Sobota (Slovenia). From 1981 to 1987, he was a member of the team for fixed denture prosthetics in the health centre in Rijeka. As one of the first ceramists in the region, he opened a private dental laboratory in 1987. Since 2003 he has worked as an opinion leader for Ivoclar Vivadent in the field of esthetic fixed denture prosthetics.

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Full-mouth rehabilitation with IPS InLine – Part 1

Metal-ceramics – the gold standard

Report by Rainer Semsch, MDT, Münstertal/Germany

The first part of this two-part report focuses on coordinated treatment planning and active communication between dentist and dental technician. Special emphasis is placed on the temporary restoration, which allows a preliminary view of the final restoration. Temporization has not only an effect on the final esthetic outcome but, most of all, plays a vital role in achieving sound functions and an accurate occlusal fit. The second part of this report will discuss the further course of treatment, including the design of the final restoration using IPS InLine metal-ceramics, to complete this complex case.

Introduction

The need for a complete oral rehabilitation is often not recognized at first sight. Instead, many difficult cases tend to be restored in a piecemeal fashion over several decades until there is nothing left that can be restored. For instance, shortcomings in the existing restorations in one jaw are not recognized but instead transferred to new crown and bridge restorations in the antagonist jaw, or adjustments and corrections are applied by grinding only to cause a further drop in the vertical occlusal height, to mention but a few examples of malpractice. Unfortunately, these procedures and similar practices are well known and widely used.

If patients, in time, develop a desire for having their oral situation altered, they are often strongly motivated by concerns about their esthetic appearance. The existing anterior crowns are no longer esthetically adequate; unsightly metal margins have started to show and the patient's own teeth look no longer vibrant and beautiful. So, the patient draws the conclusion that "something needs to happen".

What exactly "something" means, however, is often not clearly defined at first and can be interpreted in many different ways, depending on the philosophy of the practice, the technical competence of the dentist, the psychological stress and financial means of the patient and the technical skill and expertise of the technician. The resulting suggestions often differ from each other completely. Some operators select a purely esthetically oriented approach by replacing a few crowns in esthetically important places and giving high levels of instant satisfaction to the patient. Others, on the other hand, study the patient's specific situation in depth and draw the conclusion that an increase in vertical dimension is absolutely essential and recommend a complete rehabilitation. The patient is and will remain at the centre of any decision-making process and the dental team, which is planning the treatment, should make sure that they understand the wishes of the patient and should establish what treatment is optimal for the individual patient and how it can best be accomplished.

Case presentation

- 60-year-old female patient
- Oral rehabilitation of the posterior upper and lower region approx. 20 years ago (Figs 1 and 2)
- Existing crowns in the upper anterior region to correct the steep position of the anterior teeth
- Received regular prophylactic care; free of complaints at the time when the treatment decision was taken
- No acute need for treatment; a few partial crowns in localized areas were due for replacement

Keywords

- Metal frameworks
- Metal-ceramic crowns
- Diagnostics
- Treatment planning
- Temporization
- Veneering ceramics

Type

Product-related technical report

Figs 1 to 3: The preoperative view shows a dental reconstruction that has been in place for approx. 20 years.

- Reason for consultation: dissatisfaction with the esthetic situation in the anterior region (Fig. 3)

Diagnostic analysis from a technician's perspective

A panoramic X-ray revealed difficult conditions in teeth 31 and 41 with tightly positioned roots and inadequate root canal fillings. In addition, teeth 11, 21 and 22 had undergone root canal treatment and resection (Fig. 4). The periodontal conditions were sound in all places.

It was understandable that the patient expressed dissatisfaction about the esthetic situation in her upper jaw. The upper anterior teeth were too short and it was fair to say that the crowns were unsightly. These shortcomings could have easily been addressed by replacing the existing crowns. However, a more difficult situation presented itself in the lower jaw. The anterior lower teeth were severely abraded due to an overjet situation. Concomitant with the abrasion of the anterior teeth, the entire lower anterior block underwent a process of secondary eruption and lingual tilting. As a result, the lower anterior teeth were in an elevated position and dorsally conjoined by posterior teeth that appeared to form "sagging bridges" towards the rear (Fig. 5). Some of the clinical crowns in the posterior region were too short. Such irregularities are often encountered. They are the result of functional shortcomings. An assessment of the lip anatomy showed that, when the patient relaxed her muscles, the upper anterior teeth, including the soft tissue portions, were too short and the incisors were clearly too high. The inappropriate vertical height contributed to the above findings and made it difficult to improve the situation.

First ideas of how to restore this case were formed in an exchange of opinion between dentist and dental technician. This interdisciplinary exchange of expertise resulted in the conclusion that a fundamental improvement of the situation could only be attained by raising the vertical occlusal height. This meant that each tooth had to be altered and therefore a full-mouth rehabilitation was necessary.

Initial planning

As we realized that a complete oral rehabilitation was necessary to meet the wish of the patient, we began to draw up the following treatment plan:

- Extract teeth 31 and 41 because of inappropriate root canal obturation
- Endodontic treatment and crown lengthening of teeth 32 and 42 to reposition the teeth to a more lingual position
- Remove all existing crown and bridge restorations
- Implement necessary measures to build up and conserve the remaining tooth structure
- Restore the teeth first with temporary veneers, …

Fig. 4: X-ray examination

Fig. 5: The problem area is the lower anterior region, where the anterior block is located too high and the posterior teeth form a sagging line.

Fig. 6:
The mounted diagnostic models form the basis for planning the treatment in the dental laboratory.

- … then with metal-based long-term temporaries …
- … and finally with permanent restorations

Mounted diagnostic models were used to simulate both the increase in vertical height and first esthetic improvements (Fig. 6). The wax-up was transferred to a basic mock-up by means of keys made of addition-curing silicone. This allowed the patient to obtain a first impression of the planned esthetic outcome. This step is very important as it gives patients an opportunity to obtain a rough idea of how the envisaged improvement will impact on their appearance. A pleasing impression will motivate them to decide in favour of a treatment that will require a great deal of time and commitment as well as the necessary financial funds.

If a purely additive wax-up is created, an esthetic stent can be easily and quickly taken from the wax-up to provide a reasonable preview of the final outcome. This method is difficult or unfeasible in cases where the outcome is achieved by subtraction. In the present case, the increase in vertical height would result in an increase in the sagittal gap, as can be clearly seen in the mounted models. This gap would be closed by repositioning the lower anterior teeth to a more labial position. In the mock-up, the incisal edge was positioned in a clearly lower position and more to the labial side than the patient's own teeth. For this reason, they had to be optically shortened. The composite portion which was capping the natural teeth had to be shaded black in the relevant area (Fig. 7). This technique would ensure that only those facets that were shorter and tilted to the labial side would be apparent against the dark background of the oral cavity and, as a result, could be better assessed in the mock-up proper (Fig. 8). The mock-up extended to the first premolars. As a result, the increase in vertical occlusal height could also be checked during try-in. Simultaneously, the necessary crown lengthening in teeth 32 and 42 was also shown in the mock-up; for this purpose, the cervical part of the mock-up was located on the soft tissue (Fig. 9). Rather than being included in the prosthetic reconstruction, teeth 31 and 41 would be extracted. The length of the upper anterior teeth was increased by 2 mm in the mock-up; the contour of the incisal edge had been corrected to harmonize with the lower and upper lip and the bipupillary plane (Fig. 10). The patient's phonetics was also checked at the try-in.

Figs 7 and 8: The inappropriately long lower anterior teeth are "painted away" in the esthetic stent.

Fig. 9: A boost in motivation thanks to the mock-up

Fig. 10: Noticeably better: The treatment is moving in the right direction and the patient feels optimistic about it.

These "esthetic stents" are of considerable help to the patient to decide for or against a treatment. It is next to impossible to take a decision on such an extensive intervention or far-reaching alteration of the anterior esthetics in the short time available in the dental practice. Generally, the mock-up gives patients the opportunity to simulate a before/after situation by inserting and removing the stent and appraising the planned changes as well as visualizing and assessing the effects of the planned measures in their usual environment. The stent was reinforced with additional material to ensure appropriate durability.

Temporary veneers

A temporary veneer offers considerable advantages over a chairside-fabricated temporary. In addition to superior composite quality, finishing and polishing, indirect temporaries can be designed to incorporate some of the ideas and findings of the mock-up phase. However, as tooth preparation and the increase in vertical height had not yet been implemented, the temporary veneer restoration could not reflect the complete envisaged outcome in this case.

Initial preparation was carried out on the basis of the diagnostic model and kept to a minimum (Fig. 11). The material thickness of the resulting composite veneer was accordingly low. Temporary veneers are created using reliable PMMA acrylic materials such as Telio Lab, which offer a pleasing shade and are easy to use and polish to an optimal surface finish. In the present case, the temporary veneer was built up in three tiers. First, the complete shape was pressed in dentin material. The dentin crown thickness was tapered towards the incisal edge to create space for the second, translucent layer and the final incisal layer (Fig. 12). In addition, the Telio Lab materials can be used to customize the restorations quickly and easily to meet the individual needs of the patient, if necessary.

It is rather difficult to place a temporary veneer correctly if a lining is present, particularly in the lower jaw. A possibility to solve this difficulty is to seat the completed temporary on the model and cover it with flexible, high-tensile addition silicone, which is borne by the soft tissue. A spoon-like tray, which was made of a compatible composite and clearly embraced the silicone key, provided the necessary stability (Fig. 13). In the maxilla, this tray leaned against the palate, which, in addition, acted as a vertical stop.

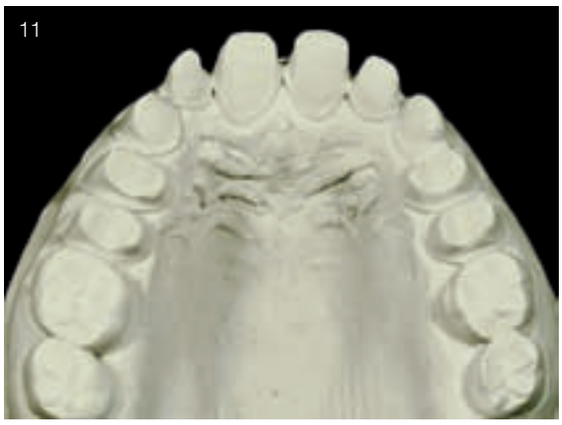

Fig.11:
Initial preparation is kept to a minimum.

Fig.12:
Three-layer temporary veneer

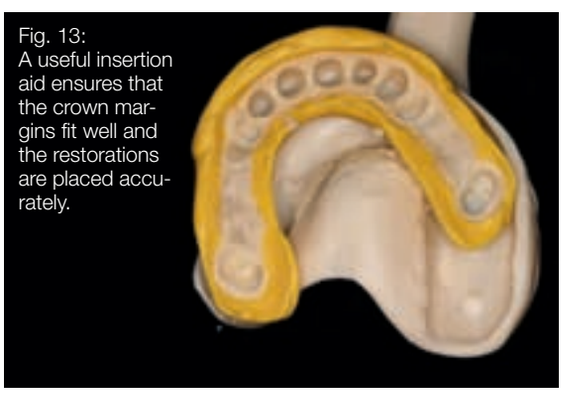

Fig. 13:
A useful insertion aid ensures that the crown margins fit well and the restorations are placed accurately.

Fig. 14:
The temporary veneer restoration has improved the situation but still more needs to be done.

Fig. 15:
Planning the next steps to further improve the esthetics and function

Impressions of the antagonist teeth are shown on the occlusal surface of the insertion aid, if available. If the upper and lower jaw have been ground, it is advisable to reline the temporary restoration in the upper jaw first and then to use the impressions of the upper temporary to position the lower temporary in the correct position when the lining material is applied. The tray stabilization resulted in a tightly fitting silicone key, which allowed only a thin composite flash to form in the cervical area and this flash could be easily removed.

The indirect temporaries were relined directly in the oral cavity of the patient. The crown margins should be impeccably finished and polished, ideally by the technician. The esthetic/ functional results of the temporary veneers are again subject to discussion and are not yet considered conclusive. However, it is essential that the temporary offers a visible improvement of the situation in the right direction (Fig. 14). The aim is to maintain and strengthen the motivation of the patient, as this is crucial to the success of the treatment. Axial inclinations, planned modifications of the soft tissue and prosthetic planes can be assessed on the basis of the temporary (Fig. 15). The diagnostic models, mounted on the articulator to reflect the current stage of the treatment, give again reference and guidance for the next planning stage.

Outcome of the temporization stage

The temporization stage led to the following results:

- Impression of the prepared teeth for fabricating the long-term temporaries (see Figs 16 and 17)
- Centric record
- Registration of jaw relations with a facebow

Although the entire treatment plan is normally discussed in detail with the patient before commencing a treat-

Fig. 16: An accurate impression …

Fig. 17: …leads to pleasing models.

Fig. 18: The situation in the articulator: A great deal of space has to be filled.

Fig. 19: Framework design for the metal-supported long-term temporaries

Fig. 20: The occlusal plane still looks very "bent"

ment, the patient tends to cast a doubt on the necessity of a complex metal-supported long-term temporary restoration at this stage. However, many aspects have already been improved by this stage and therefore the patient comes to think that not much else needs to be done expect for altering a few more minor things. In this case, the "few more things", however, meant:

- Crown lengthening of teeth 33 to 43
- Endodontic treatment/attempt at retreatment of tooth 46
- Mucogingival surgery on tooth 22
- Healing phase
- Bite raising
- Correction of the different planes of dental rows
- Designing of anterior esthetics
- Trial phase with the long-term temporaries
- Creation and incorporation of final restorations

From this stage onwards, the treatment was expected to take an additional twelve to eighteen months until completion.

Long-term temporization

Metal-based temporary restorations with metal rims were used for long-term temporization to ensure that the temporaries would not break even if they had to be frequently removed to conduct the individual treatment steps. The crowns were splinted in pairs (see Figs 18 and 19).

The metal bases can be veneered with artificial teeth (e.g. SR Phonares), which are ground internally to fit onto the metal substrate. This approach demands a great deal of effort, but denture teeth feature a superior composite quality and reduced affinity for plaque formation and therefore offer considerable advantages over light-curing layering composites (Fig. 20).

Fig. 21: The gingival margin of 32 and 43 is not yet completely healed after crown lengthening; the margin of 22 is located too high, …

Fig 22: … which remains covered by the relatively long upper lip, even when the patient smiles.

Long-term temporaries that are fabricated in such an elaborate fashion offer various advantages:

- the crowns close gaps effectively, which reduces the formation of secondary caries and supports healing
- the metal framework ensures sufficient stability
- the planned increase in vertical height is established
- the occlusion is correctly adjusted and stable
- the basis for correct tooth alignment is created
- the anterior esthetics can be optimized step by step

The new situation is now ready to be tested (Figs 21 and 22). The duration of the trial phase should be adequately long. The second part of this report will discuss the fabrication and incorporation of the final restoration.

To be continued …

Product list

Product	Name	Manufacturer/ Distributor
Impression material	Impregum	3M ESPE
Articulator	PROTAR	KaVo
Casting alloy	Harmony PF	Ivoclar Vivadent
Addition-curing silicone	Panasil putty soft	Kettenbach
Denture teeth	SR Phonares	Ivoclar Vivadent
Composite, PMMA	Telio Lab	Ivoclar Vivadent
Tray material	C-Plast	Candulor
Model plaster	Implantat-rock	Picodent
Die varnish	Goldspacer	SW-Dental

About the authors

Rainer Semsch trained as a dental technician from 1976 to 1979 in Heilbronn, Germany, and completed his final examinations in Stuttgart. From 1980 to 1981, he gained practical experience in ceramic veneering techniques in several laboratories. In 1982, he took up employment with a dental practice in Freiburg, where he gained practice in operator- and patient-centred procedures and developed methods for accomplishing sensible esthetic-functional treatment options. In 1985, he earned his Certificate as Master Dental Technician in Stuttgart. In 1987, he devoted himself to building up the applied training department of the Masterschool in Freiburg and acted as its head until 1992. He then set up and ran his own laboratory as independent dental technician in Freiburg. Together with his three employees, he specialized in fixed and removable esthetic-functional restorations and implant prosthetics. Rainer Semsch is well known from numerous national and international presentations, workshops and publications. Since 2005, he has been running his own dental laboratory as a "one man show" in Münstertal/Black Forest. In 2007, he became a member of the German Association for Esthetic Dentistry (DGÄZ).

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Full-mouth rehabilitation with IPS InLine – Part 2

Metal-ceramics – the gold standard

Report by Rainer Semsch, MDT, Münstertal, Germany

In the second and final part of this two-part report the fabrication of two crowns is described step by step to provide an example of the ceramic layering technique used in the rehabilitation of this case. The dentist/dental technician team decided to employ the metal-ceramic gold standard for the final restoration, as these materials offer the best long-term prognosis as well as high esthetics. The metal-ceramic system used for this purpose is clearly structured and ensures results that are conforming to nature.

Introduction

A comprehensive oral rehabilitation places particular demands on the quality of the work produced by the dental technician. An utmost degree of stability, functionality, precision and material quality is required. Esthetics represents another essential aspect, which is particularly important to the patient. Esthetics is a term which we in our professional environment use very pragmatically, as if we could measure esthetics or could apportion smaller or larger quantities of it to our work in progress. However, it is not clear what the term "esthetics" really means. A reason for this uncertainty may be that esthetics is not defined as a measurable unit and its meaning tends to vary according to the general cultural climate, age, social environment and many other factors outside of the realm of dentistry.

In a nutshell, esthetics means to the dental technician:

- Beauty and functionality of the individual teeth
- Harmony between the individual components
- Harmony between the restoration, lips and the face of the individual
- Strength and beauty of the overall composition

The question as to which technique and material should be used to meet these requirements largely depends on the extent of the reconstruction. In line with current thinking, all-ceramics appears to be the material of choice for single crowns in esthetically sensitive regions to achieve optimal lifelike properties.

When a complete oral rehabilitation is implemented, natural teeth that could serve as a reference are not available. This presents an appropriate opportunity to use the proven metal-ceramic technique. The metal base imparts stability and precision to the restoration; the veneering material offers an outstanding chipping rate and the requisite esthetic effect can be easily attained with these materials, as they have been undergoing development and refinement for decades.

Metal-ceramics have been used in dentistry for several decades and have proven to offer a straightforward treatment option. Essential aspects such as cementation, accuracy of fit and, if necessary, adjustments by grinding can usually be easily accomplished. It therefore made sense to decide in favour of this proven, high-stability, esthetic treatment option for the patient case presented in this report.

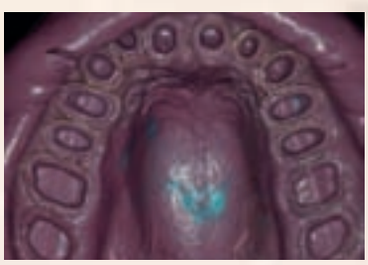
Keywords

- Metal frameworks
- Metal-ceramic crowns
- Diagnostics
- Treatment planning
- Temporization
- Veneering ceramics

Type

Product-related technical report

Figs 23 and 24: Long-term temporization



Figs 25 to 27: From preparation to model

Patient case

The patient wore a metal-supported long-term temporary for more than a year (see Part 1, dental dialogue 10/10, pages 68 to 74). This period of time offered ample time for the sites of the crown lengthening to heal, to test the new bite height and to develop the characteristics of the anterior teeth until the patient was satisfied with their esthetic appearance (Figs 23 and 24).

The lion's share of the preparation work had already been performed when the temporary restorations were placed. As the patient complained about a slight phonetic problem (tongue felt too big), the dimensions of the crowns and dies were revised. It was noticed that the upper first premolars were oversized. Reducing these preparations before impression-taking for the final restorations presented no difficulty (Fig. 25). Perfect impressions led to impeccable models (Fig. 27) and ultimately to accurately fitting frameworks. The frameworks were fabricated using a conventional wax-up technique (lost-wax technique) and silicone keys fabricated from the long-term temporaries. A high-gold alloy was used for casting the frameworks; ceramic shoulders (2/3 of margin) were prepared in the labial area.

The veneering work is described step by step on the basis of two demonstration crowns to provide examples of the layering techniques applied in the present case (Figs 28 and 29).

The preparation on tooth 21 demonstrated a relatively flat chamfer. Consequently, the height of the shoulder had to be restricted to just below 2 mm. A high-gold ceramic alloy from Ivoclar Vivadent was used for casting the framework.

The metal framework was prepared according to the manufacturer's directions and exhibited an impeccable, evenly oxidized surface after oxide firing (Fig. 30). The oxidized surface was reduced by sandblasting. After careful cleaning, the surface was masked with opaquer. The best result is achieved by applying three thin coatings of the opaquer paste supplied with the metal-ceramic system (Fig. 31). This opaquer is available in tubs and can be stirred before applying it in case the phases have separated. The next darker shade is used to apply the final coating to the palatal and occlusal areas, where experience has shown that space tends to be limited. This measure helps to subdue the brightness in this area and increase colour saturation, whilst the composition as a whole stays within the selected shade range.

Raising the level of fluorescence of the standard opaquer may present another useful adaptation. The "luminosity" from the depth of the restoration can be considerably enhanced by adding F paste to the standard opaquer.

Figs 28 and 29: Situation on the model for the demonstration crowns on teeth 11 and 26

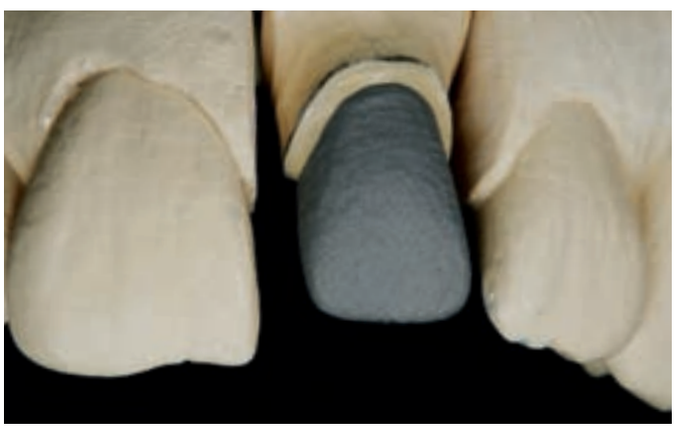


Fig. 30: Impeccable, homogeneous oxide formation on the metal framework with a reduced margin for the ceramic shoulder

Fig. 31: Applying three thin layers produces the best results. The palatal and occlusal areas are coated with opaquer of the next more intense shade.

The ceramic shoulder was built up using the known technique. The material was applied with a bulge towards the margin (Fig. 32) to control shrinkage and prevent cracking (Fig. 33). The rationale for this procedure is the fact that ceramic material always shrinks towards the centre. Two to three firings resulted in an accurately fitting margin, which only required further attention at the glaze firing stage. The margin materials exhibit a high degree of fluorescence and they are sintered at a convenient temperature. Each dentin shade is matched to a specific margin material. The margin materials produce a warm tone that is suited to the dentin layer.

Demonstration layering – anterior tooth

Six ceramic materials were used for the ceramic build-up of the crown. These six materials offer a shade range that is ample enough to fabricate extensive restorations if natural reference teeth are not available and ensure a homogeneous optical effect. The range may not be large enough to create single crowns that have to blend into the natural dentition.

The six materials in detail (Fig. 34):

- IPS InLine Deep Dentin A2
- IPS InLine Dentin A2
- IPS InLine Dentin A1
- IPS InLine Transpa neutral
- IPS InLine Opal Effect 4
- IPS InLine Incisal 2

- **Deep Dentin**
  This material is sufficiently saturated to support the dentin effect from the depth of the restoration, even if it is applied in a thin layer only. The shade is slightly more intense than that of the associated dentin material. Consequently, Deep Dentin is well suited to cervical, palatal and occlusal areas.

- **Dentin**
  Two dentin shades are suitable for being applied on top of the Deep Dentin layer to build up the shade effect of the dentin body. The basic shade is used for the cervical and central portions of the dentin body, whilst the next lighter shade is applied towards the incisal edge.

- **Transpa neutral**
  The Transpa layer is sandwiched between the dentin and the incisal layer. The dimensions of the Transpa layer control the translucency of the incisal area. At the same time, this layer separates the depth reflexion of the dentin layer from the surface

Fig. 32: Margin material in place

Fig. 33: The firing result shows high fluorescence and an accurate marginal fit.

Fig. 34: Six layering materials for standard layering schemes

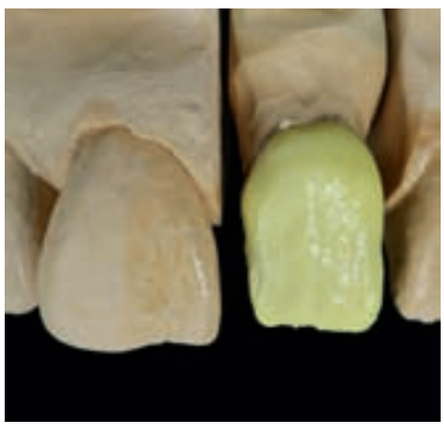


Fig. 35: Deep Dentin covers the entire crown and extends it by approx. 1 to 1.5 mm.

Fig. 36: Original A2 dentin shade

Fig. 37: Basic structure consisting of the three dentin materials Deep Dentin A2, Dentin A2 and Dentin A1

reflexion of the incisal layer. This layering scheme creates the desired optical depth.

- **Opal Effect 4**
  This Effect material is of a whitish opalescent shade and can be used on its own without appearing too dominant. It is suitable for applying shade characterizations to accentuate morphological features and to create different zones of brightness, e.g. marginal ridges in anterior teeth, transverse bands or cusp tips of posterior teeth.

- **Incisal 2**
  The Incisal 2 material is clearly more compact than the Transpa Incisal 2 material. If distinct amounts of Transpa materials are used in the incisal area, a smooth transition can be created by applying the more compact Transpa Incisal 2 material. As a result, incisal characterizations are more smoothly "packed" into the other materials.

Anterior layering

After the ceramic shoulder had been brought to the correct dimension, application of Deep Dentin was commenced. Deep Dentin was applied in a thin coating to the entire crown, extending the crown by approx. 1 to 1.5 mm (Fig. 35). This extension ensured that the heights of the framework would not be visible later on and a smooth transition between the underlying opaque metal substrate and the translucent incisal area could be achieved.
As a chamfer preparation requires a large mass of tooth structure, particularly in the central region of the body, plenty of layering material in the basic shade was applied to this area (Fig. 36). The shape of the crown was completed with a lighter shade towards the incisal margin. The crown was broadly built up in layers using the three Dentin shades. This basic structure reflected the length, width, inclination, and the facing of the envisaged result. At this stage, the incisal edge was completely formed in dentin material (Fig. 37). The ceramic layering was compacted to some degree and then the dentin crown was prepared for incisal layering. For this purpose, the dentin-incisal edge was reduced by slightly more than half the length from the labial side and the crown height was reduced in a tapered fashion to approx. half of the length of the complete crown (Fig. 38). Consequently, a dentin ledge was preserved in the palatal region and could act as support for the incisal dentin structure.

Fig. 38: Incisal area reduced for incisal layering

Fig. 39: Incisal dentin structure layered up with Deep Dentin

Fig. 40: A translucent layer is carefully applied to the incisal characterizations.

Fig. 41: Opalescent materials layered in the area of the marginal ridges

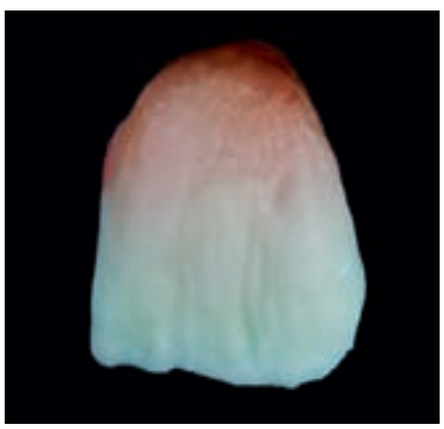


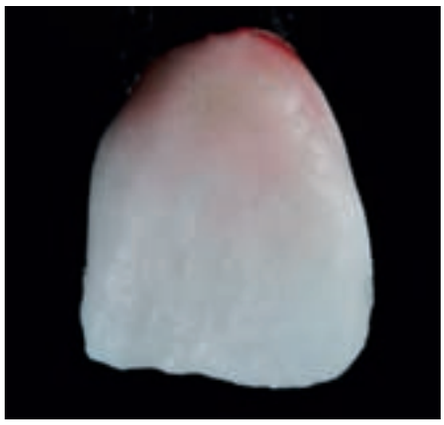
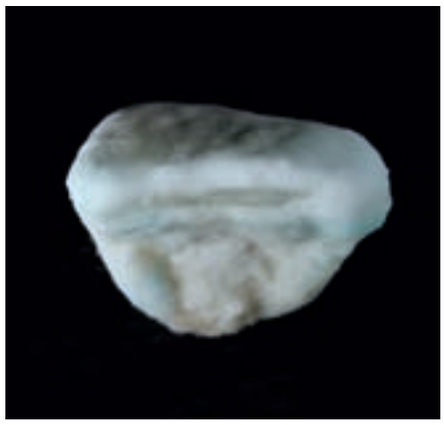
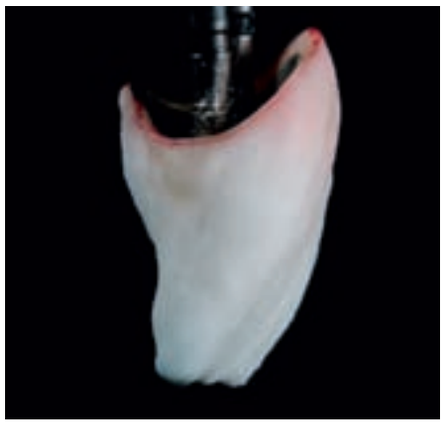
Fig. 42: After the contact areas have been reinforced, the restoration is ready for the first firing.

Fig. 43: Outcome of the first firing: All effects layered into the basic structure of the restoration can be seen, checked and corrected, if necessary.

The incisal dentin structure was first layered into the reduced area. In this case, the structure simulated a tripartite mamelon configuration. Ceramic materials undergo not only shrinkage in length but also in width. Consequently, the lateral mamelons were placed far towards the lateral edges. The Deep Dentin material, which was already used above, was applied (Fig. 39). However, purpose-designed mamelon materials could also have been used for this purpose. The dentin structures slightly exceeded the original crown length. Subsequently, translucent incisal material was applied to attain optical depth (Fig. 40). This material covers the mamelons from the labial side and overlaps them from the incisal. The layers were allowed to dry for a short while until they were firm so that the dentin incisal edge could be thinned out in the palatal region, where it was still fully shaped. Subsequently, Transpa material was placed in this area.

Opalescent whitish material was applied to accentuate the mesial and distal ridge of the anterior labial facet and to create zones with varying degrees of brightness (Fig. 41). A flat, bright connecting layer between the ridges was applied to create a slightly brighter area over the intense dentin shade. After the crown had been removed from the model die, the mesial and distal contact areas were reinforced with translucent material (Fig. 42). Built up as it was at this stage, the crown was subjected to the first firing. In sum, the following materials had been applied so far: complete dentin shades, incisal characterizations, intermediate Transpa layer and opalescent areas. The incisal material had not yet been applied (Fig. 43). Breaking the layering stage into two offers a considerable advantage: The steps carried out thus far can be checked. This is particularly important for special effects, such as mamelons, which can easily appear too short or too long after firing because of material shrinkage. Likewise, the dimension and effect of the Transpa layer can be checked and corrected, if necessary.

After completion of the first firing, the layering outcome was evaluated and the occlusal and proximal contact points were established by grinding. The restoration was completed with the basic dentin shade and the incisal material before the second firing was carried out. This time, the materials were mainly applied to complete the shape of the

Figs 44 to 46: Before the second firing, the restoration is shaped with dentin and incisal materials to establish the labial facet, torsion of the labial surface and the cervico-incisal curvature.

Fig. 47: Result of second firing: virtually completed build-up.

Fig. 48: Application of add-on material in the mesio-incisal and distal area as well as in the area of the ceramic shoulder before glaze firing

Fig. 49: Depending on the thickness of the incisal layer, the incisal characterizations may appear quite distinct or rather subtle under the milky white incisal material.

restoration, as shading and characterization had already been completed in the previous step (Figs 44 to 46).

As a larger volume of material was applied for the second firing, the firing cycle was again conducted at full temperature. The firing results showed that the layering and shaping of the restoration was largely completed (Fig. 47).

It goes without saying that the final shape of the single crown should resemble the reference tooth as closely as possible, if available. All adjustments by grinding and surface finishing were performed with a small torpedo-shaped green stone. This stone always produces a soft grinding pattern and can be used for creating flat or pointed surface structures.

Small additions to the tooth shape were accomplished with a mixture of incisal material and a low-fusing add-on material. The ceramic shoulder was adjusted using a mixture of dentin, small amount of add-on and a special wax. The mixture was applied with an electric wax knife and surplus material was removed (Fig. 48). The wax burned out without leaving residue. This technique resulted in an excellent outcome. The adjusted areas and the raised parts of the marginal ridges were manually polished after firing (see Fig. 49). As for all metal-ceramic restorations, creating a congruent shade and brightness transition between the metal-supported die and the free-standing incisal area presents a challenge. The outstandingly adjusted, subtle opaquer and the optimally coordinated veneering materials form a well-designed system that substantially facilitates this task.

Layering scheme for posterior crowns

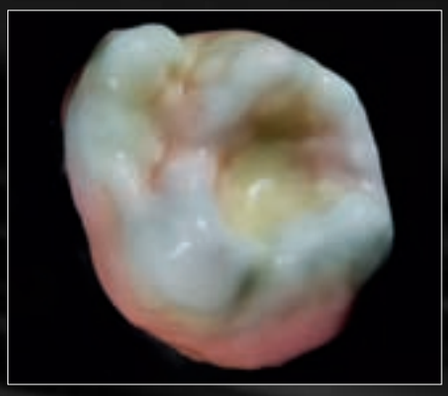
The same layering materials as above were used for layering the posterior restoration. In contrast to the anterior tooth, the cut-back technique was not used here. The individual materials were layered in the same way as in the anterior restoration.

A thin coating of Deep Dentin was applied to the crown (Fig. 50), extending the framework by approx. 1 to 1.5 mm in the shape of the dentin horns (Fig. 51). An additional two dentin materials were used to create the shade of the dentin. However, only the dentin body was built up, rather than the complete anatomical shape. The dentin body reached the top of the surface in the equatorial area and the

Fig. 50: First layer of Deep Dentin

Fig. 51: The dentin body is built up using three dentin materials.

Fig. 52: A translucent layer is applied between dentin and incisal layer to create a depth effect.



Figs 53 and 54: The layered restoration is ready for the first firing: Three dentin materials, a layer of transcluent material and whitish opalescent material have been applied thus far.

horns were built more tightly as they still had to be covered with incisal material. Only moderate amounts of dentin were applied to support the cusp slopes. These areas should mainly be built up with incisal materials (Fig. 52).

Same as in the anterior restoration, the dentin body was coated with a layer of translucent material to attain the desired optical depth. The thickness of this layer served to control the depth effect and the brightness of the final result (Fig. 53).

Finally, a few essential characteristics, such as the cusp tips and the transverse crest, were accentuated with whitish opalescent Opal Effect 4 material (Fig. 54).

After the first firing, the shade of the occlusal surface was intensified (Fig. 55) to achieve a more distinct relief effect in the completed restoration. The stain material was fixed to the underlying material using low temperatures (approx. 700 °C / 1292 °F) to ensure that the effects stay in place when they are overlayered with additional material. This technique of using stains to create or intensify effects has been described by Japanese master ceramists for several decades.

Dentin A2 material was applied to the dentin body and Incisal I2 to the occlusal surfaces to prepare the restoration for the second firing. This layering stage was used to build up the specific morphology and functional structure of tooth 26 (Fig. 56). As a large amount of layering material was applied, it was again necessary to carry out the firing at full temperature (Fig. 57).

The intricate structure of the occlusal surface necessitated the use of special tools (Fig. 58). A tungsten carbide tip ("Steger tip") was used to contour the deep recesses of the fissures. This step was easy to achieve due to the favourable firing result. After having established the functional aspects by grinding, the cusp slopes were smoothed using a small stone and a small diamond ball or tip in the deeper portions of the restorations. The green stone was again utilized for the final shaping of the outer areas. A silky mat surface finish was attained by means of an abrasive wheel with synthetic bristles. After these preparations had been completed, the restoration was ready for glaze firing. Glaze materials are not required if the compact In-Line ceramic materials are processed as described above (Fig. 59).

Conclusion

A complete oral rehabilitation poses formidable challenges to the patient, dental team and dental technician. As can be seen in the above case, the dura-

Fig. 55: Effects may be created or intensified with stains before the second firing.

Fig. 56: The restoration is ready for the second firing.

Fig. 57: A very pleasing firing result

Fig. 58: These four instruments are utilized for contouring and creating a silky mat surface – ideal conditions for glaze firing.

Fig. 59: Minor adjustments can be added at the glaze firing stage. The colouration accentuates the depth and height of the relief and the compact ceramic shows a silky mat surface finish, creating an esthetically pleasing result.

Fig. 60: The position of the lower anterior teeth appeared too “wild” for the patient.

Fig. 61: After a few more try-ins, satisfaction was achieved.

tion of the treatment alone demands the patient’s utmost trust, patience and willingness to cooperate. The technical expertise of both the dentist and dental technician is equally important to attain an outcome that gives long-term satisfaction to the patient. In this respect, the quality of the materials supplied by the dental industry is also of decisive importance. In the present case, the IPS InLine metal-ceramic system from Ivoclar Vivadent was used with great success.

An esthetically balanced system that offers long-term reliability forms the basis to design the laboratory-based work for a full-mouth rehabilitation. Metal-ceramics have been successfully used and further developed in the course of several decades. Nowadays, all-ceramic restorations appear to dominate. Nonetheless, metal-ceramics continue to be the most frequently used technology – and for a reason. Even if metal framework fabrication may change, the veneering work in-

Figs 62 to 64: Completed crowns and bridges of the 28-unit restoration – still in the laboratory

Fig. 65: Situation at the beginning of the treatment …

volving the creative design of shape and shade will remain an integral part of dental lab work and hence metal-ceramics will continue to present the gold standard.

Completion of treatment

The crowns for the patient were designed in exactly the same way as demonstrated in this report to complete the treatment. The individual restorations were tried in and adjusted several times during the initial firing phase (Figs 60 to 61) until overall acceptance and satisfaction was achieved. Fine occlusal adjustments were performed intraorally before glaze firing. Consequently, hardly any adjustments were necessary after the final incorporation of the crowns and an initial trial phase.

Finishing a total of 28 crowns was time-consuming: Several ceramic shoulders had to be lined, surfaces designed and minor adjustments applied before glaze firing. However, the final outcome was worthwhile the effort (Figs 62 to 64).

The soft tissue was reinforced in the region of tooth 22 to stabilize the gingival area, which had been weak in that area already at the beginning of the treatment.

Product list

Product	Name	Manufacturer/ Distributor
Impression material	Impregum	3M ESPE
Articulator system	Protar	KaVo
Stone/Plaster		
- Articulation	A 50	Picodent
- Model, super hard	Implant-rock	Picodent
Ceramic system	IPS InLine	Ivoclar Vivadent
Alloy, high-gold	Sagittarius	Ivoclar Vivadent
Long-term temporary	Telio Lab	Ivoclar Vivadent
Polishing brush	Habras Disc extra coarse	Hatho
Polishing paste	Diamant polishing paste	Reilive
Abrasive tools		
- Stones	Silicon carbide, green	Komet/Gebr. Brasseler
- Diamond balls	Size 009	Komet/Gebr. Brasseler
- Tungsten carbide tips	Special tool H97/H99	Komet/Gebr. Brasseler

Fig. 66: … and the metal-ceramic restorations a short while after having been incorporated; the soft tissues need a bit more time to heal.

Fig. 67: The patient two years after the successful rehabilitation. The entire treatment took more than three years to complete and the patient showed an admirable amount of persistence, trust and patience.

About the authors

Rainer Semsch trained as a dental technician from 1976 to 1979 in Heilbronn, Germany, and completed his final examinations in Stuttgart. From 1980 to 1981, he gained practical experience in ceramic veneering techniques in several laboratories. In 1982, he took up employment with a dental practice in Freiburg, where he gained practice in operator- and patient-centred procedures and developed methods for accomplishing sensible esthetic-functional treatment options. In 1985, he earned his Certificate as Master Dental Technician in Stuttgart. In 1987, he devoted himself to building up the applied training department of the Masterschool in Freiburg and acted as its head until 1992. He then set up and ran his own laboratory as independent dental technician in Freiburg. Together with his three employees, he specialized in fixed and removable esthetic-functional restorations and implant prosthetics. Rainer Semsch is well known from numerous national and international presentations, workshops and publications. Since 2005, he has been running his own dental laboratory as a "one man show" in Münstertal/Black Forest. In 2007, he became a member of the German Association for Esthetic Dentistry (DGÄZ).

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IPS InLine PoM: focussing on the advantages of the press-on technique

Is layering on the way out?

An article by Christoph Zobler, Max Wörishofer and Harald Gritsch, all Innsbruck/Austria

The method of pressing ceramic material onto metal frameworks combines the benefits of the casting technique with the esthetic options of pressable ceramics. The press-on technique is regarded as a particularly efficient way to fabricate esthetic restorations. In this article, the dental technicians Christoph Zobler, Max Wörishofer and Harald Gritsch present the working steps required for the fabrication of a ten-unit bridge with IPS InLine PoM (Press-on-Metal).

Introductory thoughts

In order to be productive, companies strive to achieve the maximum output with the minimum input. Therefore, computer-assisted design and production techniques (milling, laser sintering, etc.) are ideal solutions for modern dental laboratories. Especially in terms of homogeneity and the absence of tension, CAD/CAM-fabricated objects are often far superior to those made conventionally. In addition, the new design and production technologies offer the advantage of allowing existing frameworks to be exactly reproduced. In contrast, if something goes wrong during the casting of dental structures (which, as a matter of fact, is not so rare), the time that has been invested and the envisaged profit are irretrievably lost. Nevertheless, casting is still the most commonly used and most popular technique, and this is not bound to change at anytime soon. The reason is that, given the prevailing time pressure in the laboratories, dental technicians can work productively by using manual techniques with which they are familiar and by applying tried-and-tested materials.

Many dental technicians find the precise creation and re-creation of tooth shapes in wax a highly satisfying activity. This is probably a significant reason for the quick increase in the popularity of the press-on technique, which has become a widely used standard method in dental laboratories. An additional advantage is the fact that the material can be pressed to full contour on virtually all alloy types: high-gold, reduced-gold, palladium-based and base metal alloys. Alloys with a silver content higher than 10 percent present the only exception.

Focus on function

For the patient case described in this article, a functional ten-unit wax-up was created on the six existing prepared natural teeth (11, 13, 15, 21, 23, 25). With this wax-up, the tooth shapes and positions and the occlusion were preliminarily checked and determined in a time- and cost-efficient fashion. A silicone template was created from this wax-up, and particular attention was paid to the vestibular support of the template. Subsequently, the wax-up was trimmed and a circular framework made of Callisto CP+ was fabricated on the basis of the wax-up. This palladium-based alloy, which is suitable for a wide range of indications, is precisely coordinated with the press-on technique and compatible with all popular veneering ceramics.

After divesting, the cast Callisto CP+ framework is tried in on the model so that tension-free fit is ensured (Fig. 1). Then, the circular margins are reduced in order to provide the conditions for the esthetic and biocompatible marginal adaptation with a ceramic shoulder. The framework is then blasted with aluminium oxide in the usual way, oxide firing is conducted, the framework is blasted again and the IPS InLine Opaquer is applied and fired twice (Fig. 2). The framework is weighed in this state. This step is required in order to determine the weight of the wax that was used for the wax-up, and this value serves as the basis to calculate the amount of press ceramic material and thus the number of ingots needed.

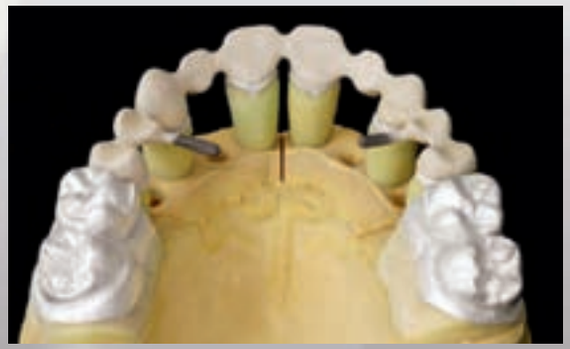
In the cervical area, light-curing resin that burns out without leaving residue is applied instead of wax. More precise and thus more stable margins can be created with this type of material (Fig. 3). The

Keywords

- Function
- Press-on-metal
- Efficiency
- Wax-up

Type

Product-related user report



Figs 1 and 2: The casting method is probably still the most commonly used fabrication technique in dental technology. After the framework has been fitted to the model, the cervical margin is reduced in order design a circular ceramic shoulder, and two opaquer firings are conducted.

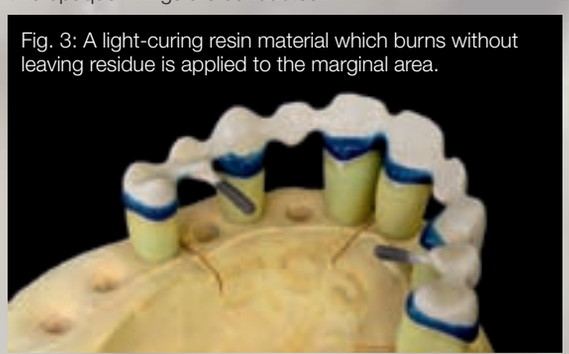


Fig. 3: A light-curing resin material which burns without leaving residue is applied to the marginal area.

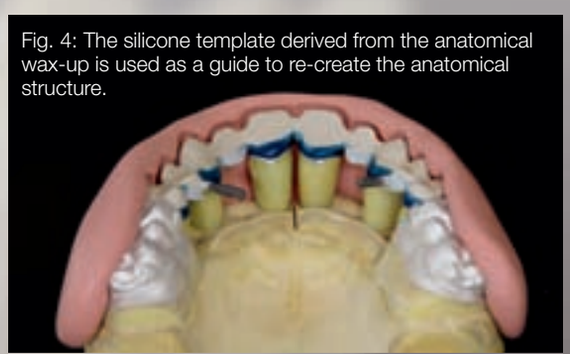


Fig. 4: The silicone template derived from the anatomical wax-up is used as a guide to re-create the anatomical structure.

anatomical shape can now be modelled either directly on the framework that has been pre-treated in this way or by utilizing the previously fabricated silicone template (Fig. 4). All the previously established anatomical and functional aspects, such as anterior/posterior guidance, can be easily and comfortably transferred to the model, and the wax structure may be tried in and possible alterations discussed with the patient (Fig. 5).

A minimum thickness of 0.8 mm must be ensured for the wax-up.

Never lose track of the goal

A wax sprue with a maximum length of 8 mm and a diameter of 3 mm is attached to the thickest area of each element of the wax-up. It is advisable to attach these press sprues at an angle of 45 ° to 60 ° and to use the investment ring designed for IPS e.max ZirPress and IPS InLine PoM (Fig. 6); in this case, the 300 g investment ring was used. IPS PressVEST or IPS PressVEST Speed are available for investment purposes. Both materials can also be used for ceramic inlays or onlays made of IPS e.max ceramics and for the press-on-zirconium technique, for instance. Mix-ups and errors are therefore almost excluded and stock-keeping is much easier for the laboratory.

The investment ring is preheated to 850 °C (1562 °F). The ingots that have been selected according to the tooth shade and the IPS e.max Alox Plunger are inserted into the hot investment ring, and the investment ring is placed in a Programat EP 5000 press furnace previously preheated to 700 °C (1292 °F). As soon as the furnace has attained the required temperature of 950 °C (1742 °F), the ingots are automatically pressed into the investment ring.
When the investment ring has cooled to room temperature, it is separated with a separating disc in the area of the aluminium oxide plunger and the plunger is carefully removed from the investment material with tongs using rotating movements. It is crucial to divest the pressed objects according to a specific procedure; this means that you first remove the investment material around the sprue cone with glass polishing beads and 4 bar (60 psi) pressure. The sprues are then separated and the pressed objects are carefully divested using a pressure of 1 to 1.5 bar (15 to 22.5 psi) (Fig. 7).

Streamlined to the essentials

The 20 Chromascop, 16 VITAPAN classical A1–D4 and the Bleach shades can be reproduced with just seven press ingot shades. The final shade effect of the divested and cleaned press ceramic restorations is achieved with the Shade, Stains and Glaze materials of the IPS InLine system. First, however, the ceramic shoulders are carefully finalized and the surface texture is created. The stains firing is carried out afterwards (Fig. 8).
More than two Stains firings are usually not necessary. The glaze material is applied in two additional firing cycles and in thin layers in order to avoid pooling of the material. This imparts a lifelike appearance to the restorations (Fig. 9), which preserves their surface texture in spite of the glazing.

Fig. 5: Tension-free modelling: All anatomical and functional aspects can be easily realized with ceramic material in the press-on technique.

Fig. 6: The press sprues are attached at an angle between 45° and 60° using the 300 g investment ring of the IPS InLine PoM system.

Figs 7a and b: Before the pressed objects are entirely divested, the press sprues have to be separated. This eliminates tensions which might occur during the cooling of large press cones.

Fig. 8: Achieving esthetics in a short time: More than two stains firings are rarely necessary.

Figs 9 and 10: Pooling of the glaze material must be prevented, in order to obtain a clearly defined surface structure.

Equipped for the future

Given the pressed-on shoulder, the restoration is also highly satisfactory in terms of its esthetic appearance. Because the cervical margin of the restoration is not made of metal but ceramic, light may enter the restoration, which is dispersed to create a lifelike shade effect. Metal frameworks pressed over with IPS InLine PoM thus represent an interesting alternative to other metal-ceramic restorations. There is no doubt that, at this point, an individually layered ceramic restoration, fabricated by an experienced technician according to the state of the art, is esthetically superior to a stained pressed ceramic crown.

However, dental restorations fabricated with the press-on technique according to the manufacturer's instructions set a new benchmark in terms of quality. Given the standardized procedure, ceramic veneers fabricated in the press technique ensure reproducible quality with consistent physical values (for instance strength values).

Another advantage of this technique is the fact that functional aspects can be directly transferred with all details from the wax structure. As the pressed objects are not subject to any shrinkage, subsequent eccentric interferences or chipping due to improper functional design can be prevented, if the preliminary work is done properly (Fig. 11). Another positive aspect of this method, apart from the esthetic appearance, is the possibility of creating a metal-free circular ceramic shoulder. This aspect influences both the overall esthetics and the biocompatibility of the restoration (Figs 12 and 13).

It is quite safe to say that technology leaders are already working hard on a way to combine the advantages of the press-on with those of the layering technique. With such a solution, labial esthetics would be achieved by individual layering, so that no esthetic compromises would have to be made if the treatment team opts for pressed restorations.

Given the wealth of technical possibilities, it is a notable feat of IPS InLine PoM to allow us dental technicians to focus on our core competences again. As a result, esthetics does not become secondary, but rather our knowledge about the functional aspects of the masticatory system becomes our primary concern again. It remains to be hoped that more dental technicians will start to exploit the full potential of their articulators (Fig. 14). Smaller laboratories would benefit from this in particular. It is conceivable that in the future the metal frameworks would be fabricated using CAD/CAM technology, the posterior teeth and the circular shoulders would be pressed-on with ceramic material and a highly esthetic layering material would be individually fired onto the anterior teeth. With material concepts such as this one, we are looking confidently ahead to a promising and exciting future of dental applications.

Fig. 11: The shape and function that is created with wax is directly realized in IPS InLine PoM material. Subsequent occlusal adjustments are therefore rarely necessary.

Figs 12 and 13: The circular ceramic shoulder is expedient: It creates a metal-free interface at the biologically sensitive area and offers esthetic advantages, as the transmission of light into the restoration is improved.

Fig. 14: Applying long-standing knowledge again: With the press-on technique and IPS InLine PoM, dental technicians may focus again on the functional aspects and make use of the full potential offered by their articulators.

Product list

Product	Name	Manufacturer/ Distributor
Articulator system	Stratos 300	Ivoclar Vivadent
Investment material	IPS PressVEST	Ivoclar Vivadent
Resin, light-curing	Delta-Form	DeltaMed
Model stone	Silky-Rock	Whip Mix
Base metal alloy	Callisto CP+	Ivoclar Vivadent
Opaquer	IPS InLine Opaquer	Ivoclar Vivadent
Press and ceramic furnace	Programat EP 5000	Ivoclar Vivadent
Press-on ceramic system	IPS InLine PoM	Ivoclar Vivadent
Silicone putty	SHERADUETT soft, Shore hardness 85	SHERA
Wax	S-U-Ästehtikwachs-O, beige	Schuler Dental
Gingiva model, soft	Gingifast Rigid	Zhermack

About the authors

Christoph Zobler completed his dental technology training in 1983 at the Senoner laboratory in Innsbruck, Austria. He worked for the University Clinic for Dental, Oral and Maxillofacial Medicine in Innsbruck during his training and continued this work until 2004. Christoph Zobler specializes in the fields of function, planning and all-ceramics.

Max Wörishofer finished his dental technology apprenticeship in 1990 at the Blumberger laboratory in Mötz, Austria. He worked at the University Clinic for Dental, Oral and Maxillofacial Medicine in Innsbruck between 1996 and 2004. Wörishofer specializes in implant prosthetics, all-ceramics and zirconium oxide.

Harald Gritsch completed his dental technology training in 1983 together with Christoph Zobler at the Senoner laboratory in Innsbruck, Austria. He worked at Machek laboratory in Innsbruck from 1987 to 1990. Gritsch also worked at the University Clinic for Dental, Oral and Maxillofacial Medicine in Innsbruck from 1991 until 2004. Harald Gritsch specializes in all-ceramics, anterior esthetics, combination restorations and complete dentures.

The biographies of the three authors have one date in common: 2004. This was the year when they founded the Inn-Keramik dental laboratory. All three have given lectures at different further education seminars. In 1998 they held a lecture series in Austria on the topic of the fabrication of all-ceramic restorations, which was documented by means of patient cases. Zobler, Wörishofer and Gritsch worked as lecturers at the Clinic for Dental, Oral and Maxillofacial Medicine in Innsbruck from 2000 to 2004. Since 2002, they have collaborated in material studies by Ivoclar Vivadent. They have authored numerous specialized publications and cooperated in 2005 in the preparation of the Metal-Ceramic Framework Design Manual and Implant Superstructure Manual from Ivoclar Vivadent.

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How to achieve lifelike pink and white esthetics in fixed-detachable implant-retained dentures

A step-by-step guide to the creation of pink and white esthetics

Article by Jörg Richter, MDT, Freiburg/Germany

Implants have become an established method of providing retention for prosthetic dentures. As a result, the demand for implant-retained restorative solutions is on the rise. Furthermore, new surgical techniques and new materials enable dental professionals to fabricate increasingly sophisticated restorations. While only the retention of the prosthetic restoration was the objective of the treatment in the early days of implantology, a perfect final result in terms of esthetics and function is the main concern today. These changed requirements demand new approaches – both on the part of the clinician and the dental technician. In this article MDT Jörg Richter shows how, by combining different materials, lost dental hard and soft tissue can be optimally reconstructed with implant-borne prosthetic restorations. The combination of composite and ceramic materials allows dental technicians to fully concentrate on the reconstructive case at hand, without running the risk of damaging the framework or the veneering ceramic as a result of too many firing cycles.

Introduction

Implants have become an established dental treatment concept to provide retention for prosthetic dentures. Therefore, implants have developed a loyal following, which is growing steadily. Due to augmentation techniques for soft and hard tissues and the availability of new materials, the restorations that are fabricated are becoming increasingly sophisticated. While the re-creation of function, i.e. the retention of the prosthetic restoration, was the sole objective in the early days of implantology, today's treatments strive for perfect esthetic harmony between the implant, the restoration and the soft tissue. Given this complexity, new solutions had to be explored in the creation of functional and esthetic restorations. This article presents different materials which can be ideally combined with one another to re-create the pink and white esthetics in cases involving missing teeth and lost gingiva by means of implant-retained dentures: composites and ceramics. The advantage of this materials combination is that in a first step the ceramic parts are created. The pink parts are created with composite material, which harmoniously blends in with the ceramic veneering, in a second and final step.

Initial situation

In most cases, long-span implant-retained restorations involve a ceramic veneer which is fired onto a compatible alloy framework. In cases such as the one discussed in this article, the dental technician is required to design the framework in such a way that the ceramic material is ideally supported. The framework design is a particular challenge in areas where the bone has atrophied. The two main aspects which need to be considered in this context include a uniform layer thickness of the metal-ceramic in order to prevent tension after firing and the colour simulation or the adaptation of the artificial gingival portions to the colour of the natural tissue. In order to achieve an appropriate shade effect in metal-ceramic veneering materials, the number of firing cycles should be reduced to a minimum. This is not always easy when implant-retained reconstructions, which can be quite complex in some cases, are fabricated. Thus, an approach is pursued which involves the veneering of teeth with metal-ceramics and the gingival portions with composite material.

Finding the appropriate materials combination

In order to implement the concept described above, the individual products were selected according to different criteria.

For the ceramic veneer, the highly esthetic IPS InLine ceramic was selected. With this material, veneers can be individually layered, on the one hand, and on the other hand, due to the systems concept, this product line offers the possibility of pressing the full-contour ceramic restorations with IPS InLine PoM on the framework and subse-

Keywords

- Esthetics
- Casting technique
- Hard and soft tissue reconstruction
- Implant-retained denture prosthetics
- Composite
- Metal-ceramics
- Veneering technique

Type

Product-related technical article

Fig. 1: The wax-up is the basis for all dental planning steps; in this case, a fixed-detachable implant-retained restoration was planned.

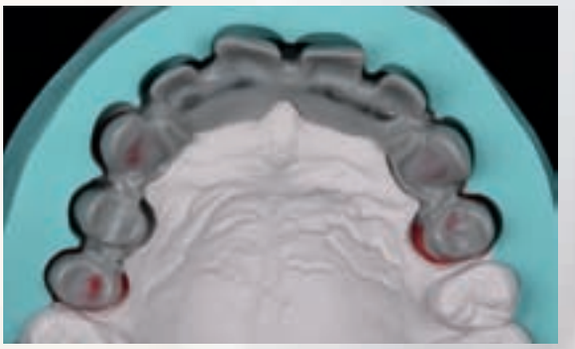

Fig. 2: The wax-up was selectively reduced to the framework shape by utilizing the silicone template based on the wax-up. Furthermore, the dimensions and the ceramic support were checked.

Fig. 3: The completed wax framework. A gingival portion with framework support was planned in the area of teeth 21 and 22.

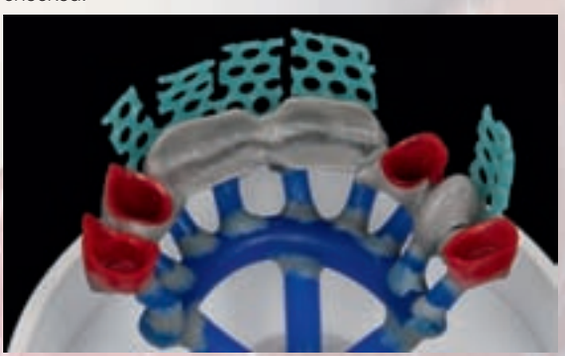

Fig 4: Cooling vents were added to the sprued framework, which was prepared for investment.

quently staining them. Irrespective of the processing technique you choose, the opaquer is the same in both cases.

As in the gingiva concept of Ivoclar Vivadent all veneering materials, ceramic or composite, are shaded in the same way, SR Adoro was chosen to re-create the pink esthetics. The need for additional firing cycles was thus eliminated, and relining would be possible even after a long wear period. SR Adoro was polymerized with heat and light in order to ensure complete curing. This counteracts discolourations and prevents the accumulation of plaque. Due to these properties, SR Adoro is the ideal solution for gingiva reconstructions in implant-retained restorative cases.

The individual working steps that are required to fabricate a fixed-detachable implant-retained restoration are described below.

Framework fabrication

Given the sufficient availability of osseous tissue in the patient, four Straumann Bone Level implants were placed in the area of teeth 15, 13, 23 and 24 in order to ensure sufficient support of the restoration. For the detailed planning of the restoration, a complete wax-up (Fig. 1) was created and recorded with a silicone template.

This silicone template provided the standard for the subsequent working steps. The silicone template was used as a guide for the reduction of the wax-up for a precise framework design. During this step, care was taken to ensure that the framework was reduced so as to leave enough space for a veneer of a uniform thickness and to optimally support the veneering material (Fig. 2). At the same time, sufficient stability of the framework had to be ensured, which is largely influenced by the physical properties of the alloy used; the alloy Callisto Implant 78, which has been specifically developed for implant superstructures, was chosen. The silicone template was again used as a guide.

In the cervical-labial area of teeth 12 to 22, the framework was designed in such a way that the envisaged gingival portions were supported by the metal framework (Fig. 3).

The completed wax framework was then sprued on the sprue former and cooling vents were added (Fig. 4).

After investment and heating, the Callisto Implant 78 alloy was cast according to the manufacturer's instructions. The cast framework was divested after the investment ring had completely cooled. Rough divestment was done by means of sandblasting, while finer residues at the crown margins or abutments were removed in an ultrasound bath.

Ceramic veneering

The superstructure was then fitted to the model and the alloy surface was prepared for the oxidation firing (Fig. 5).

To ensure a sound bond to the veneering ceramic, a first, thin opaquer layer was applied as a wash and fired at 930 °C (1706 °F). The metal framework was only completely masked after

Fig. 5: The framework was blasted prior to oxide firing, in order to increase the surface.

Fig. 6: After oxide firing, the opaquer was applied; first, a thin film was applied for the bond. For the second opaquer firing, the framework was completely masked.

Fig. 7: Ceramic layering for the first dentin firing. Dentin material was applied in a reduced tooth shape …

Fig 8: … then Transpa clear, Transpa Incisal 3, Opal Effect 1, Opal Effect 4 and Mamelon yellow-orange were successively applied.

Fig. 9: The result after the first firing cycle. The effects were already clearly visible at this stage.

Fig. 10: For the third firing cycle, the final tooth shape was created with successive layers of different Transpa Incisal materials and Opal Effect 1.

the second opaquer firing. Different shades were already used for the application of the opaquer; in the area of the gingiva, the pink opaquer was used; for the teeth, the corresponding tooth-shaded opaquer was applied. Furthermore, an opaquer with a more intensive shade was applied in the cervical and proximal areas at this stage (Fig. 6).

The dentin portions were built up in a reduced form in accordance with the dental anatomy. In the fabrication of the four incisors, particular attention was given to the creation of the cervical areas, because after completion, the transition between the gingiva and the teeth should look natural.

A 1:1 mixture of Occlusal Dentin orange and Dentin A2 materials was used as a basis in the occlusal and palatal areas in order to create a lifelike shade effect (Fig. 7).

The incisal area was created by successive layers of different Effect materials of the IPS InLine system (Transpa clear, Transpa Incisal 3, Opal Effect 1, Opal Effect 4 and Mamelon yellow-orange) (Fig. 8).

After the first firing, the veneer already exhibited a very lifelike appearance (Fig. 9). The final tooth shapes were built up by applying successive layers of different Transpa Incisal materials and Opal Effect 1 (Fig. 10). The silicone template was used as a guide also in this step. Therefore, the tooth shape/anatomy was very close to the final result after the second firing cycle.

The final corrections were done with Incisal and Opal materials. After the final ceramic firing cycle, minor shape adjustments were made and the surface texture was designed. Before glaze firing, slight shade accents were created with staining materials (Fig. 11).

In order to achieve a natural-looking lustre, the ceramic surface was polished with a felt wheel and pumice. The result after mechanical polishing was impressive in terms of esthetics and individuality (Fig. 12).

After the IPS InLine veneer had been completed full attention could be given to the creation of the pink esthetics with SR Adoro, due to the materials concept selected. The polymerization of SR Adoro with light and heat does not influence the shrinkage of the veneering ceramic and does not exert thermal strain on the metal framework.

Gingiva reconstruction

The bond between the IPS InLine and SR Adoro materials was achieved by means of a silanization, which was preceded by a surface conditioning. The bond was established in three steps:

The ceramic surface has to be activated by blasting it with Al_2O_3 (2 bar / 29 psi, 100 µm) or etching with IPS Ceramic Etching Gel. In both cases, the surfaces which do not have to be etched had to be protected. In the present case, we

Fig. 11: Individual characteristics were created with stains prior to glaze firing.

Fig 12: The result: The white esthetics were very lifelike after mechanical polishing.

Fig. 13: For the pink esthetics, another approach was chosen: Prior to the application of the composite material, the area that needed to be veneered was etched, …

Fig. 14: … a suitable bonding agent was applied …

used the etching technique and applied a thin wax layer on the ceramic areas which required protection (Fig. 13).
Subsequently, Monobond Plus was applied and allowed to react for 60 seconds (Fig. 14).
Immediately after this step, a thin layer of Heliobond was applied, slightly dispersed with oil-free air and cured for 60 seconds with the Quick light-curing unit. After the bonding surfaces had been conditioned in this way, the SR Adoro Gingiva material was built up (Fig. 15).
The creation of a lifelike gingiva is a special challenge, because over the past few years the focus has been on the shaping and layering of teeth, and consequently the reconstruction of the gingiva and the reproduction of its shades has been somewhat neglected. However, the topic of the gingiva is gaining in importance, particularly in the context of implant-retained restorations.

As a result of differences in thickness, blood supply and pigmentation, gingival tissue exhibits many different shade characteristics. These characteristics need to be re-created with SR Adoro material. Due to the individual layering and the various gingiva shades available, very esthetic reconstructions can be achieved. For an appropriate depth effect, the first layers were applied with more intensive gingiva shades (SR Adoro Gingiva 5/Intensive Gingiva 4). Towards the surface, brighter materials with a higher translucency provided for a natural-looking appearance. The layers that were applied were individually polymerized with the Quick light and thus tacked in place. In order to prevent an inhibition layer from forming, the entire composite area was covered with SR Gel before final polymerization. This step was conducted with a Lumamat 100 unit and utilizing light and heat (104 °C / 219 °F). Only minor shape adjustments and polishing of the surface were required in order to complete the gingival portions created with SR Adoro Gingiva. Rubber polishers were used for preliminary polishing, and a smooth surface was achieved with silicone polishing wheels. Goat's hair brushes and cotton and leather buffing wheels were used together with a universal polishing paste to create the high-gloss finish.

The resulting restorations featured lifelike gingival tissue, which was created without requiring additional firing cycles and thus without exposing the framework alloy and the veneering ceramic to any additional thermal strain (Figs 16 and 17).

Fig. 15:
… and the artificial gingival portion carefully built up. The initial layers consisted of materials with a deep-red shade.

Figs 16 and 17:
The completed restoration: exceptional pink and white esthetics.

Fig. 18:
This black-and-white image reveals a completely different aspect of pink and white esthetics; the transitions are harmonious and the dimensions and shapes are appropriate.

Conclusion

New and interesting possibilities for complex implant-retained restorations arise from the metal-ceramic treatment concept consisting of the alloy Callisto 78 and the IPS InLine metal-ceramic system in combination with SR Adoro for the gingival portions (Fig. 18).
This concept offers patients highly esthetic restorations which are comfortable to wear. Restorations which require gingival areas to be reconstructed in particular can now be fabricated with a reasonable amount of effort, while risks are minimized.

Product list

Product	Name	Manufacturer/ Distributor
Etchant	IPS Ceramic Etching Gel	Ivoclar Vivadent
Investment material	Starvest Press 2	Weber
Rubber polishers	–	Komet/Gebr. Brasseler
Implant system	Bone Level	Straumann
Putty silicone	picodent twinduo extra hard	Picodent
Composite resin	SR Adoro	Ivoclar Vivadent
Alloy	Callisto Implant 78	Ivoclar Vivadent
Metal-ceramic	IPS InLine	Ivoclar Vivadent
Modelling material	picopoly	Picodent
Polishing paste	Universal Polishing Paste	Ivoclar Vivadent
Silicone polishers	–	NTI
Universal primer	Monobond Plus/Heliobond	Ivoclar Vivadent
Wax	Thowax	Yeti Dental

About the author

Jörg Richter, born in 1972, completed his dental technology training at the Dentaltechnik Rund dental laboratory in Nimburg in 1994. In 1995 he completed his military service as a dental assistant. He earned his master craftsman title in 2000 in Freiburg. In the same year, he was employed by the Zahnwerkstatt Bötzingen. In 2004 he moved to Los Angeles, where he worked at the Zahnwerkstatt Beverly Hills. One year later, he returned to Bötzingen and started working at the Zahnwerkstatt on a freelance basis. He has been working as a freelance dental technician at Malek Misrabi Zahntechnik in Freiburg since 2007.

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