

reflect

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A new smile for Andrea

Digitally manufactured interim rehabilitation
of a challenging case

08 Simplified layering technique for superior-quality posterior restorations

Presentation of a bilaminar histo-anatomical layering approach

20 Esthetic results even on discoloured substructures

Value and brightness control with the IPS e.max system


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Editorial

Dear Reader

Digital transformation does not happen overnight. It is a long-term process. We see this quite clearly in the dental industry. Whilst CAD/CAM has become an established fabrication method in dentistry we are yet to experience the full force of the fourth industrial revolution.

Digital connectivity and flexibility – what does it all mean for us? Production processes that are becoming increasingly automated; people interacting with machines, software and materials. The Digital Denture system, which offers a digital process for manufacturing removable dentures, provides a good example. It takes removable denture fabrication to the digital level. The system promises consistent excellence as a result of its exclusive denture design software and coordinated materials in combination with specialized manufacturing strategies and the cutting edge PrograMill PM7 milling machine.

In this edition of Reflect, Canadian denturist Eric Kukucka gives us a glimpse of what the future holds in store for us in his account of a highly complex case. The article entitled “A new smile for Andrea” shows that the meaning of a prosthetic rehabilitation produced with Digital Denture goes much deeper for a patient than receiving new teeth and a new smile. Dentures affect a person’s individuality, health, well-being and quality of life. Therefore, in our enthusiasm for all things digital we should always remember that it is the patient who is at the centre of our efforts.

Warm regards

A handwritten signature in black ink, appearing to read 'S. Gómara', written over a light grey background.

Sonia Gómara
Managing Director Ivoclar Vivadent Spain





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All-ceramic single-tooth restorations for treating damaged dental enamel



Long-term results in patients with and without amelogenesis imperfecta

By Dr Andrea Klink, Dr Fabian Hüttig, both from Tübingen/Germany, and Dr Martin Groten, Reutlingen/Germany

Teeth that have been affected by extensive wear or a genetic disorder can be successfully restored with adhesively bonded all-ceramic restorations. The following article summarizes the outcomes of a series of complex clinical cases.

Two different groups of patients require the rehabilitation of impaired full dentitions:

1. Patients whose teeth show extensive erosion, abrasion or attrition caused by their diet (e.g. consumption of energy drinks) and/or overuse (e.g. grinding)
2. Patients who have a genetic disorder that affects the tooth structure and the composition of the tooth enamel (e.g. amelogenesis imperfecta, AI) (Figs 1 to 3)

Patients in the first group usually start experiencing problems (e.g. pain and compromised esthetics) in their forties and fifties. The teeth become shorter and look yellowish; parts of the existing tooth structure become fragile and a loss of vertical dimension occurs. Patients with a genetic enamel defect generally require treatment when they are in their teens. Today's advanced all-ceramic and adhesive systems allow minimally invasive tooth preparation

and they produce durable, functional and esthetic restorations.

Before treating patients with dental erosion, it is important to obtain their full medical history (e.g. bulimia nervosa or reflux disease) and find out about their eating habits. If possible their general practitioner should also be involved in the treatment. If the patient is experiencing functional problems, these should be addressed in a pre-treatment phase. In patients with a congenital defect of the tooth structure, a thorough clinical and radiological examination is of utmost importance, since in addition to the enamel defects (Figs 4 and 5), these individuals may



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01 to 03 — Three phenotypes of the autosomal dominant inherited amelogenesis imperfecta in the anterior teeth of three sisters



04

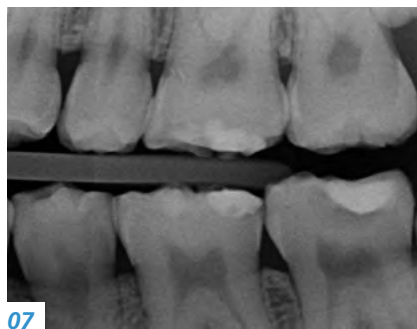


05

04 and 05 — The posterior teeth of AI patients also show different types of enamel defects. The enamel layer may be missing entirely.

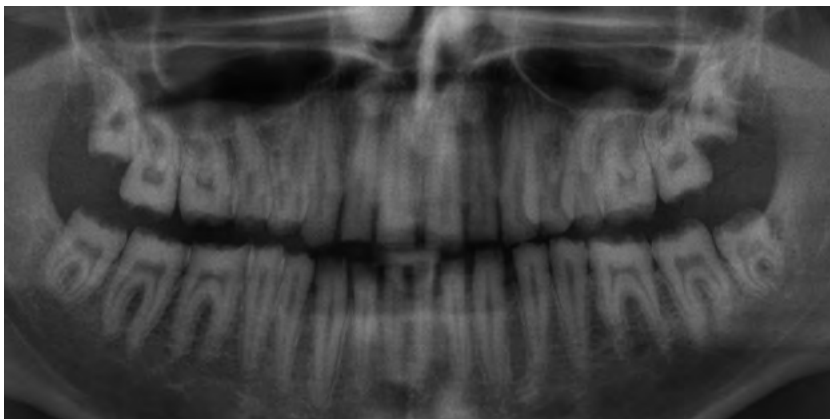


06



07

06 and 07 — The entire crown of tooth 23 is missing (Fig. 6). The bitewing radiograph (Fig. 7) shows normally formed dentin: parts of it are bare, while other parts are covered with only a thin layer of enamel.



08 — The panoramic radiograph shows a severe form of AI. None of the teeth show any enamel coverage.



09 — In many cases, the dentin colour deviates considerably from the norm. It is therefore important to select the correct tooth shade for an esthetic outcome of the monolithic crowns.

also suffer from follicular cysts, abnormal tooth eruption, retained or impacted teeth, an open bite or dental pulp calcification (Figs 6 to 8). The disorder is furthermore associated with gingival and periodontal disease. This must be taken into consideration in the preliminary treatment of

hypomineralized and hypocalcified enamel. Depending on the severity of the impairment of the enamel formation, an adhesive bond may be much weaker than it would be on healthy enamel. As a result, the adhesive bond must be generated in the dentin in most cases (Fig. 9).

10 — Grade 3 chipping of an IPS Empress II anterior crown after 16 years. The restoration was repaired by adhesively bonding the fragment in place again.

11 — Classical fracture of a molar crown (in this case Celay silicate ceramic, Vita Zahnfabrik) after 14 years. The crown was completely removed and a new restoration was placed after minimal preparation.



At present, no guidelines or scientific reports of an evidence-based protocol are available for the treatment of patients with AI. In a long-term study conducted at the Tübingen University Hospital, we identified the type of complications which could arise with adhesively placed all-ceramic single-tooth restorations in the mentioned patient groups.

Data base and examinations

For our study, we selected patients who regularly attended the recall appointments and who had been treated as follows:

Single-tooth restorations (crowns, partial crowns) made of silicate (Si) or lithium disilicate ceramic (LiDi) had been placed with an adhesive composite.

Table 1 (QR code on page 7) contains a list of the materials used.

The patients had lost a maximum of four teeth. The missing teeth were replaced with not more than a three-unit all-ceramic bridge or a single-tooth implant with an all-ceramic crown. The patients whose vertical dimension of occlusion had to be opened by more than 4 mm were given an occlusal appliance which they had to wear 24/7 for at least four months before the treatment. The rapid developments in the field of all-ceramic materials continue to open up new treatment modalities. Initially, however, feldspathic and leucite-reinforced silicate ceramics were copy-milled to produce esthetic single crowns, which could be used in posterior teeth and were placed with the adhesive technique.

IPS Empress® II of the first generation of LiDi ceramics reduced the fracture risk due to improved mechanical properties. It was followed by the optimized IPS e.max® Press.

A clinical check-up program was initiated in order to monitor the quality of the treatment results. Therefore, the tooth status, periodontal probing depth and papillary bleeding index as well as the quality of all the restorations were annually assessed and classified according to the Ryge criteria. Irreparable fractures, tooth loss and deep probing depths were classified as “absolute failures”. If the quality of a restoration was deemed to be compromised, but a new restoration was not justified, it was classified as a “relative failure” (e.g. chipping, cracking of the ceramic).

Patients, observations and results

The study involved 17 patients between the ages of 12 and 69 (at the time of the restoration placement) and a total of 450 restorations (**Table 1 – QR code on page 7**). Nine of the patients suffered from some form of AI. The patients were observed over a period of maximum 17 years. During this time, the following complications occurred in 44 restorations (10 %) in 11 patients (65 %):

- Eleven of the 44 restorations were classified as “absolute failures”, which translates to an overall survival rate of 99.8 % after three years and 91.4 % after ten years. No significant differences were noted between patients with or without AI.
- Thirty-three of the “relative failures” were caused by chipping (25). It is interesting to note that 11 of the “chip-offs” were recorded in one patient alone. Despite the observed complications, the success rate was 95.7 % after three years and 81.4 % after ten years. A statistically relevant difference was noted between patients with and without AI. The success rate of patients with AI was significantly higher.

Discussion

The long-term performance of the different materials shown in **Table 1 and 2 (QR code on page 7)** was assessed on the basis of adhesively bonded single-tooth restorations. During an observation period of ten years, we found that fractures of single-tooth silicate ceramic restorations were spread over the entire length of time (**Figs 10 and 11**), whereas lithium disilicate crown failures tended to



12 — Photo of the restorations placed in the patient shown in Figure 2 after five years of service.

occur towards the end of it. These results are comparable to those in the literature. Nevertheless, it must be noted that even though the number of restorations involved in our study was high, the number of patients was relatively low. Consequently, our findings are limited in terms of their validity. However, they do allow us to identify certain trends.

Molar restorations fractured most frequently: after about five years of service and primarily in patients whose vertical dimension had not been opened. The type of material used may have been responsible for the fractures or the restorations may have been too thin. We were surprised by the fact that the patients with AI had fewer complications than the patients without AI. We had assumed that their restorations would not perform as well due to the “unfavourable” conditions for the adhesive bond. Age may have played a role in this finding, since the patients with AI were about 24 years younger on average compared with the other subjects. In addition, the results of the AI patients showed that adhesive all-ceramic restorations do not cause any endodontic problems. Therefore, they can be classified as a long-term treatment option. Nonetheless, the teeth of patients with AI require circumferential preparation to prevent any weak areas such as cement lines and to restore the function and anatomy of the teeth.

Summary

Adhesively cemented all-ceramic single-tooth restorations achieve excellent clinical results irrespective of the initial situation (Fig. 12). However, patients with a history of functional problems are expected to have a higher rate of technical complications. Overall, it is likely that about two in one hundred crowns every year will show some sort of complication after five to ten years of service and that primarily restorations

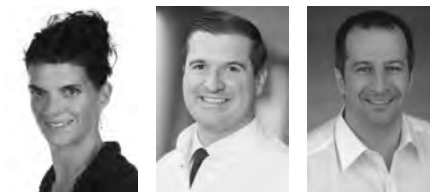
in molars will fracture. Therefore, we recommend at least one check-up per year in order to treat any complications as early as possible and therefore minimize the risk of failure.

Annotation

The present results were previously published in the following article: Klink A, Groten M, Huettig F; Complete rehabilitation of compromised full dentitions with adhesively bonded all-ceramic single-tooth restorations: Long-term outcome in patients with and without amelogenesis imperfecta. *J Dent.* 2018 Mar;70:51-58. doi: 10.1016/j.jdent.2017.12.011. Epub 2017 Dec 21.



Tables 1+2
online



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Simplified layering technique for superior-quality posterior restorations



Presentation of a bilaminar histo-anatomical layering approach

By Dr Gianfranco Politano, Rome/Italy, and Assoc. Prof. Marleen Peumans, Leuven/Belgium

Flowable bulk-fill materials and medium-translucency composite resins offer an efficient method for restoring posterior teeth. This article presents a fast and straightforward layering protocol on the basis of two different cases.

Today, there is a strong trend towards streamlining dental materials and procedures. We would like to show that simplification and good quality are not a contradiction in terms when posterior teeth are restored with proven direct materials. Furthermore, we have developed a method to heighten our efficiency which involves a simplified layering protocol and a composite material that is easy to adapt to the remaining tooth structure.

Straightforward and efficient

In this article, we present a simplified layering protocol for the placement of direct composite restorations in posterior teeth. In the two cases described, we used Tetric EvoFlow Bulk Fill as the dentin replacement and a medium-translucency nanohybrid composite A2/A3 (IPS Empress® Direct and Tetric® EvoCeram) as the enamel replacement. Clinical experience has shown that the combination of these two material used

with a bilaminar histo-anatomical layering method results in restorations that blend in seamlessly with the surrounding tooth structure. In the two cases, a simplified layering protocol was used to place superior-quality restorations in posterior teeth in only 30 minutes.

One of the benefits of streamlined products and procedures is that clinical protocols are easier to standardize, thereby reducing the risk of error. If we look at the different steps of the clinical procedure, we see quite clearly that cavity preparation cannot be simplified. To ensure the longevity of the restoration, the cavity must be properly prepared according to the biomechanical analysis.

However, with regard to the adhesive protocol, it can definitely be streamlined by making use of a contemporary universal adhesive (e.g. Adhese® Universal). It can be applied in several modes: etch-and-rinse, self-etch or self-etch with prior

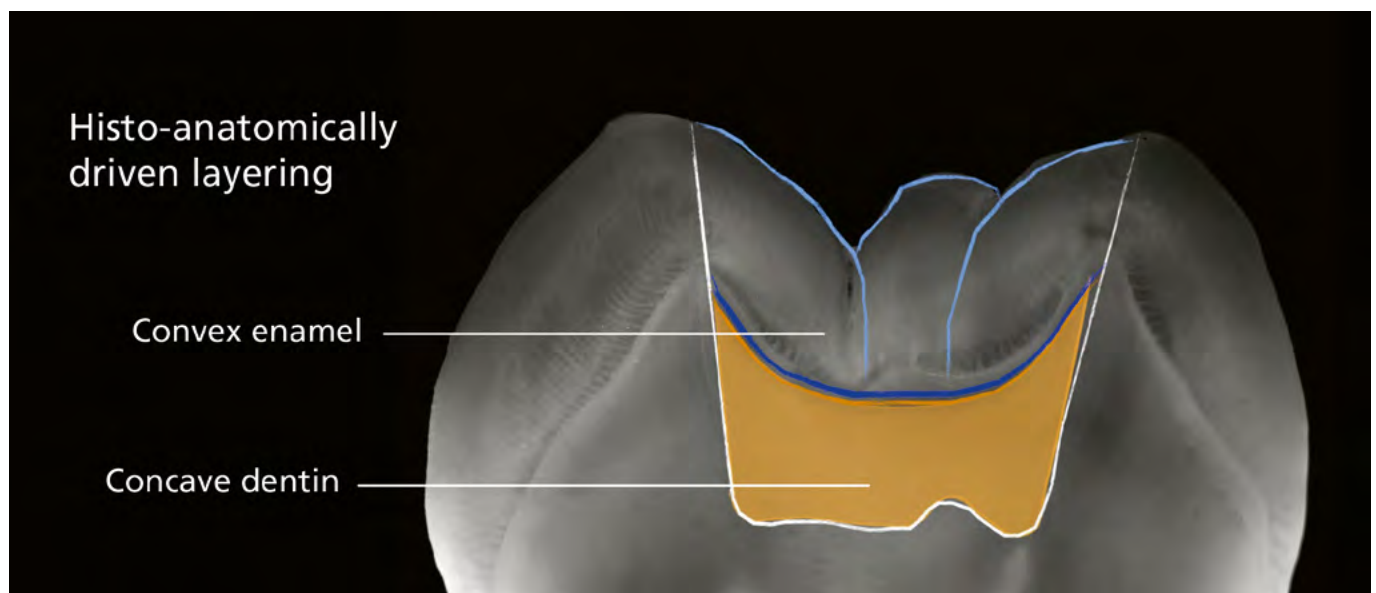
selective etching of the enamel with phosphoric acid. The restoration is then efficiently placed by following a simplified layering protocol, taking three important aspects into account:

1. Application of the histo-anatomical bilaminar layering technique

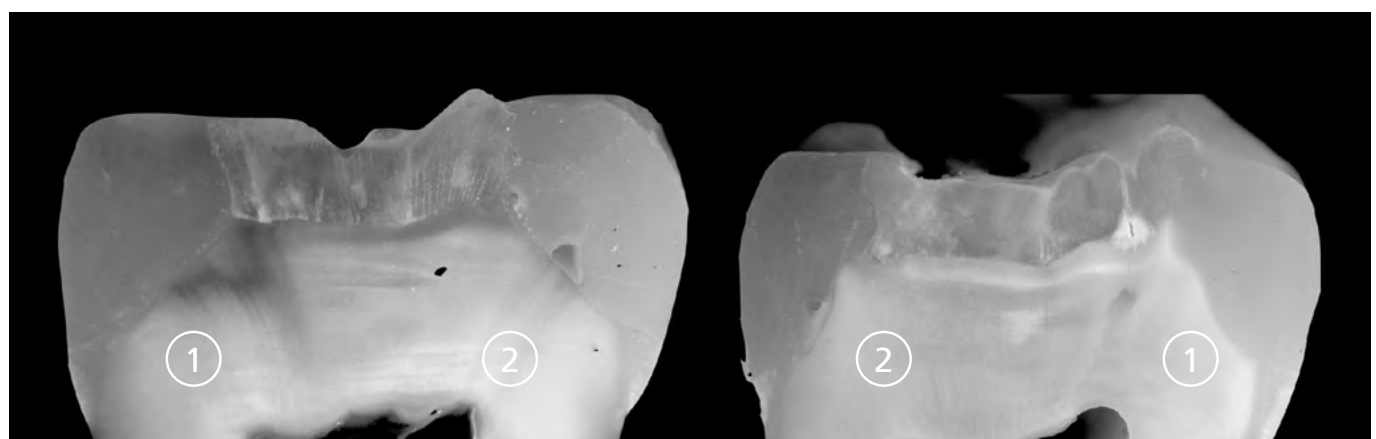
The objective is to copy the natural tooth. Therefore, the histo-anatomical build-up of the natural tooth has to be reproduced: The natural occlusal dentin is concave, while the enamel is convex. This biological fact (Bazos et al., 2011) has to be taken into consideration during the composite layering process. As a result, the dentin composite will be layered in a concave way and the enamel composite in a convex way (Fig. 1). Layering according to this "bilaminar" technique is simple. In the prepared occlusal cavity, the enamel and dentin can be clearly distinguished so that the dentin and enamel composite can be efficiently applied in the correct spatial order. An additional advantage of the bilaminar histo-anatomical technique is that there is minimal risk of making visual mistakes when grinding in the occlusion.

2. Selection of the composite materials for dentin and enamel replacement

A highly filled flowable composite resin should be selected as the dentin replacement. This type of material readily adapts to the cavity margins, the cavity floor and the overlying conventional composite layer (Fig. 2). In addition, flowable composites show low shrinkage stress because of the elastic bonding effect. A flowable composite is easy to apply as a dentin replacement, since it automatically assumes the concave shape of the dentin. Very deep cavities are quickly filled with a product such as Tetric EvoFlow Bulk Fill, for example. This flowable composite resin has a high filler content of 52 vol %. The patented light initiator Ivocerin in combination with the Aessencio Technology enables you to apply this flowable composite in 4-mm thick layers, which nevertheless can be reliably cured. During the polymerization process the translucency of the flowable composite drops from 28 % to a low < 10 % which is very similar to that of natural dentin. Furthermore, the material has convenient self-levelling prop-



01 — The natural occlusal dentin layer has a concave shape, while the enamel layer is convex.



02 — Treatment of two molars with Class II cavities: flowable composite (1) and conventional composite (2). The flowable composite shows better adaptation.

erties, and it optimally adapts to cavity walls. Finally, Tetric EvoFlow Bulk Fill shows low shrinkage stress, as the material contains an elastic resinous filler known as a shrinkage stress reliever, in addition to the standard fillers. The dental enamel is replaced using a medium-translucency material (A2/A3) that imitates the optical properties of natural dental enamel. The esthetic IPS Empress Direct materials and the clinically proven Tetric EvoCeram composite are suitable for this purpose. As described, the enamel material must be applied in a convex way, according to the successive cusp build-up technique: that is, the cusps are built up in individual steps. An enhanced esthetic effect can be attained by characterizing the occlusal fissures with a brown stain (IPS Empress Direct Color Brown). This results in the optical separation of the cusps. In addition, the stain seals the fissures, thereby decreasing the possibility of plaque accumulation and simplifying the polishing of the occlusal surface.

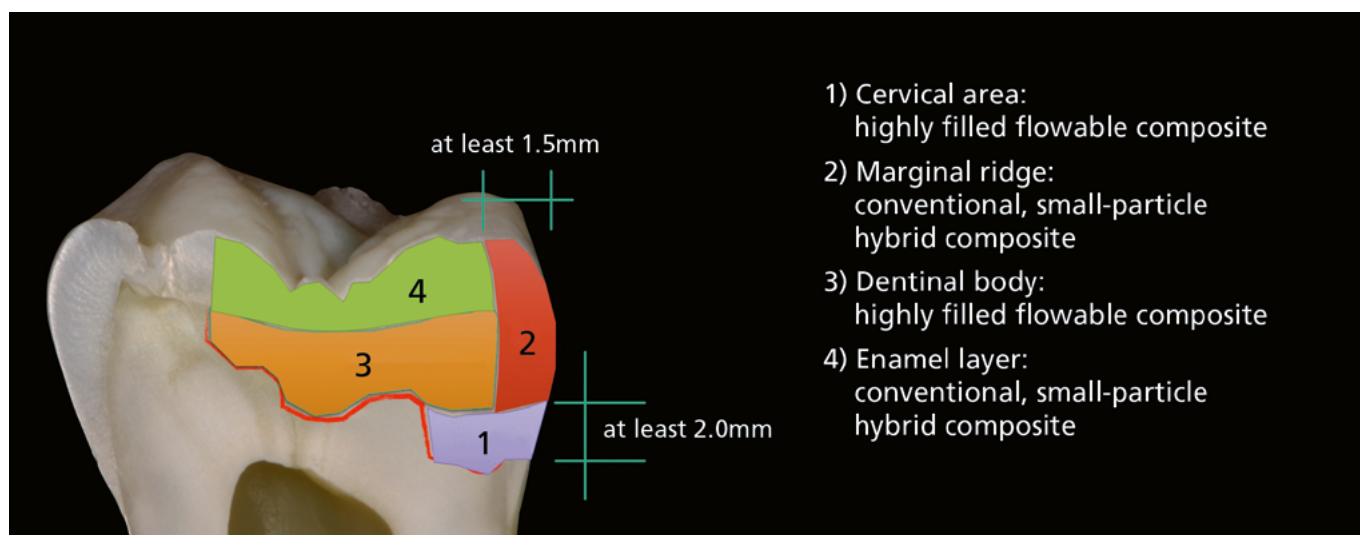
3. Layering protocol for Class II restorations

When the proximal box of a Class II cavity is filled, the layering process starts with the placement of a highly filled flowable composite in the cervical part of the cavity. This layer should be at least 2 mm in thickness (Fig. 3). The aim is to improve the marginal adaptation in the cervical area of the preparation. The proximal enamel wall is built up with conventional nanohybrid enamel composite in order to obtain the best possible physico-mechanical properties within the marginal ridge area. Once the Class II cavity has been transformed into a Class I cavity further layering can take place as described above. The layering procedure is further simplified and accelerated by using Tetric EvoFlow Bulk Fill as the dentin replacement, since this material is applied in one step (in the box and the occlusal part). Nevertheless, the maximum thickness of this layer must not exceed 4 mm.

In the last step of this clinical procedure the functional requirements are checked and the restoration is finished and polished. These steps can be simplified by ensuring the following points:

- A precise evaluation of the occlusion and articulation of the initial situation will prevent any over-contouring of the occlusal surface.
- In the treatment of Class II cavities, the correct selection and positioning of the matrix band will avoid the use of excessive amounts of composite material.
- When the cusps are modelled according to the successive cusp build-up technique, attention must be paid to giving the cusps the correct inclination and to leaving enough space for the antagonist cusp. This will significantly reduce the time needed for adjusting the occlusion as well as finishing and polishing.

The restorations are easy to finish and polish to a high surface gloss with the three silicone polishers of the Astropol set. The polishers must be used in the correct order: that is, in decreasing grit size. The grey polishers are suitable for finishing the occlusal surfaces and the margins. They are operated at a speed of 10,000 rpm with water-cooling. These polishers remove the scratches that were created by the diamond bur when the occlusion was ground in. Subsequently, the green and then the pink polishers are used to polish the restoration to a high gloss shine.



03 — Layering scheme for a Class II restoration. The flowable Tetric EvoFlow Bulk Fill can be applied in one step (layer 1 and 3) with a maximum increment thickness of 4 mm.

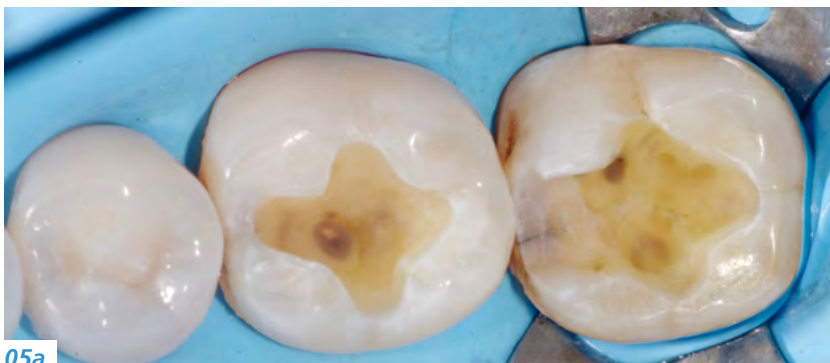
Case 1

A 35-year-old patient requested us to replace the amalgam restorations in her first and second lower molars. She complained of pain in the last molar when she chewed. The clinical pictures showed unacceptable restorations in both of the teeth (Fig. 4). After having applied the universal adhesive system Adhese Universal, we replaced the dentin with Tetric EvoFlow Bulk Fill (Fig. 5). This flowable composite resin has very good self-levelling properties and automatically assumes a concave shape. In the second molar, the flowable bulk-fill material was applied in one increment in the occlusal part and in the proximal area of the preparation and subsequently polymerized with the Bluephase light curing device (light output 1200 mW/cm²) for 20 seconds.

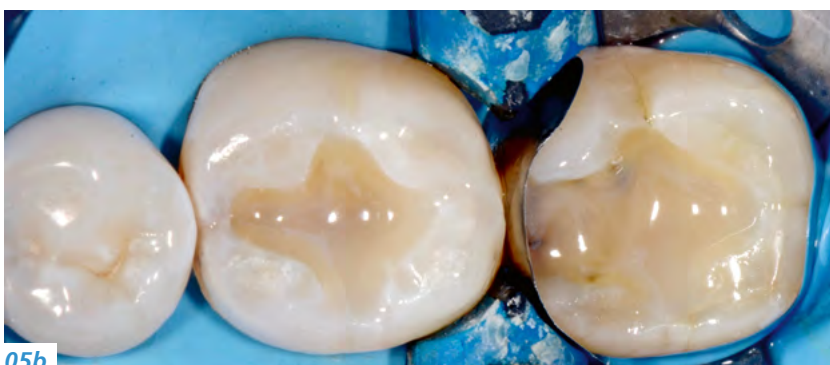
The manufacturer recommends light curing of 10 seconds. The layer did not exceed 4mm in thickness. Due to the Aessencio Technology, the opacity of the flowable material increased significantly during the light curing process (Fig. 5). Next, we replaced the enamel with the medium-translucency Tetric EvoCeram A3 material using the successive cusp build-up technique. We stained the fissures with IPS Empress Direct Color Brown (Fig. 6). Once we had removed the rubber dam, we checked the occlusion. As the cusps had been built up



04 — Case 1: Defective restorations in two lower molars



05 — Replacement of the dentin layer using Tetric EvoFlow Bulk Fill. Due to the Aessencio Technology, the opacity of the composite increases during the polymerization process.



06 — Replacement of the enamel with a medium-translucency composite (Tetric EvoCeram A3) using the successive cusp build-up technique. The fissures were characterized with IPS Empress Direct Color Brown.





07 — Result after finishing and polishing

in the correct way, only minimal adjustments were required. We finished and polished the composite restorations using the three polishers from the Astropol composite polishing kit. The surfaces of the completed restorations were attractive in their simplicity and blended in seamlessly with the surrounding tooth structure (Fig. 7).

Case 2

A thirty-year-old patient presented with defective restorations in two lower molars (Fig. 8). We placed a rubber dam and removed the old restorations. In the process, we found numerous carious lesions (Fig. 9). We removed the infected dentinal tissue with a round tungsten carbide bur at a low



08 — Case 2: The two molars required direct composite restorations.



09 — When the old restorations were removed, numerous caries lesions were revealed.



10 — Prepared cavity after air-abrasion with aluminium oxide



11 — Reconstruction of the dentin layer with Tetric EvoFlow Bulk Fill (after curing)



12 — Result after finishing and polishing. The enamel layer was rebuilt one cusp at a time with IPS Empress Direct Enamel (A2).

speed. Next, we cleaned the prepared cavities by air-abrading them with aluminium oxide particles (30µm). We did not reduce the slightly undermined buccal cusp of the first molar, as it was not exposed to heavy loading during occlusion and articulation (**Fig. 10**).

The composite was placed using a bilaminar approach. The concave dentin layer was replaced with Tetric EvoFlow Bulk Fill.

After the polymerization step, the composite showed a significant increase in opacity, and the material effectively masked the discoloured bottom of the cavities (**Fig. 11**). We used IPS Empress Direct Enamel in shade A2 to replace the enamel. Subtle staining of the fissures with IPS Empress Direct Color Brown created an optical separation of the cusps. The finished and polished restorations looked very attractive and could not be distinguished from the natural tooth structure (**Fig. 12**).

Conclusion

Superior-quality composite restorations can be placed in posterior teeth in a normal time frame. The bilaminar histo-anatomical layering protocol significantly simplifies the treatment process. A highly filled flowable bulk-fill composite showing a dentin-like opacity and an enamel composite resin exhibiting medium translucency are key elements of this protocol.



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From a dental materials supplier to a system provider



Interview with Michael Taube, Chief Marketing Officer, Schaan/Liechtenstein

“In future we will not think in terms of offering individual products, but comprehensive product packages and solutions, which will be of significantly more value to the customer than a single product on its own”, says Michael Taube, Chief Marketing Officer of Ivoclar Vivadent. These packages include specialized advanced education offerings and world-class customer service.

Mr Taube, over the past few years Ivoclar Vivadent has evolved from a supplier of dental materials to a provider of comprehensive dental product systems. Why did this happen?

We realized that we had to focus more closely on satisfying the needs of our customers and on maximizing customer value. Our aim is to provide our customers with the best possible service and support right where they need it.

This is not an easy task in an increasingly complex economic and social environment.

Yes, that is very true indeed. Nevertheless, we believe that these complex conditions offer a great deal of potential for our company. Our coordinated products and integrated systems are designed to make life easier for our customers. People who buy our solutions know that everything will work together.

Please give us an example.

Certainly. The 3s PowerCure system, which we introduced at IDS 2019, is a good example. It comprises a light-curing device, an adhesive and two different restorative materials: Tetric PowerFill and Tetric PowerFlow. The value of these products is maximized by their special combination. The system enhances the efficiency of direct restorative procedures and the quality of the restorations. As a result, dentists can place more restorations in less time.

How has the 3s PowerCure system been received by the market?

Extremely well. The feedback from users has been very positive.

How do these systems affect the way in which Ivoclar Vivadent operates?

As I have already mentioned, our systems comprise not only materials, but also the equipment needed to process them. By extension, our equipment is linked to our after sales service with which we ensure the high quality of our equipment. Our focus on systems has had a considerable effect on our research and development work. We no longer think in terms of single products alone, but rather in terms of complete packages, which will offer additional value for our customers.

What role will the International Centers for Dental Education (ICDEs) play in your plans for the future?

They will play a very important role. The company's advanced training programs allow us to teach customers how to use our products properly and get the most out of them. We have been investing in this field for a long time and will continue to do so in the future. The 56 company-owned or partner-operated ICDEs throughout the world will be working together more closely in the future and will be offering enhanced learning opportunities featuring not only traditional classroom courses at the centres but also online learning modules. This is known as blended learning. Furthermore, we plan to organize more of our own educational events such as the International Expert Symposium (IES) and the "Seminario" in Mexico City, which took place in late summer with over 6000 participants.

When is the next IES meeting scheduled to take place?

It will be held on 12 and 13 June 2020 in the heart of Paris and it promises to be extremely interesting. The different venues of the two-day event are absolutely amazing. They represent a unique combination of the past and the present and provide an impressive backdrop to the event. The presentations will take place in "Le Carrousel du Louvre".

What can the participants expect?

We will be discussing issues related to the future of dentistry under the expert guidance of fifteen notable speakers and professionals from all over the world. Moreover, we have partnered with the University of Paris to conduct this prestigious event. Ivoclar Vivadent is very proud of this partnership, because it enables the company to present topics that are based on the latest scientific research. In addition, Associate Professor Dr Jean-Pierre Attal from the University of Paris has agreed to chair the symposium.

As of when can delegates register?

From now on. They will find all the necessary details about the lectures, speakers and rates as well as hotel recommendations and information about the venues on the event website. Space is limited as usual. I would advise people who are interested in participating to register as early as possible. We look forward to welcoming a full house of dental experts from all over the world in Paris!

Event website:

www.ivoclarvivadent.com/ies2020



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A new smile for Andrea



Digitally manufactured interim rehabilitation of a challenging case

By Eric D. Kukucka, DD, Windsor/Canada

In the complex case of Andrea, a team of prosthetic experts demonstrated how a new denture can literally change the life of a patient. An interim denture was fabricated for the young patient using the Digital Denture process. This solution immensely improved the patient's well-being and quality of life.

The following article describes the interdisciplinary treatment approach taken to treat a young patient who suffered considerably from physical and psychological issues which stemmed from her dental condition (Fig. 1). In order to solve such a case, the smooth collaboration of the dental practice and the dental laboratory is indispensable, in addition to excellent dental and dental laboratory expertise and coordinated manufacturing techniques. In the present case, the solution started with an interim denture, which allowed the patient to regain her "normal" jaw function and esthetic appearance.

Patient history

When Andrea consulted us for the first time at 25 years of age she had already suffered from various symptoms for several years. Her complaints were caused by two different disorders, which led to serious consequences, individually and

in combination. The young woman suffered from a genetic disorder, one of the symptoms of which presents as very weak tooth enamel. Furthermore, the patient was afflicted with fibromyalgia, a chronic pain disorder accompanied by immense psychological stress. As a consequence, the patient had been vomiting three to four times a day on average over a period of several years. The resultant acid erosion significantly damaged her already severely compromised dentition (Fig. 2).

Effects of the illness

The patient reported that she was experiencing unbearable pain and that she had



01a



01b



01c

01 — Initial situation: young patient suffering physically and emotionally



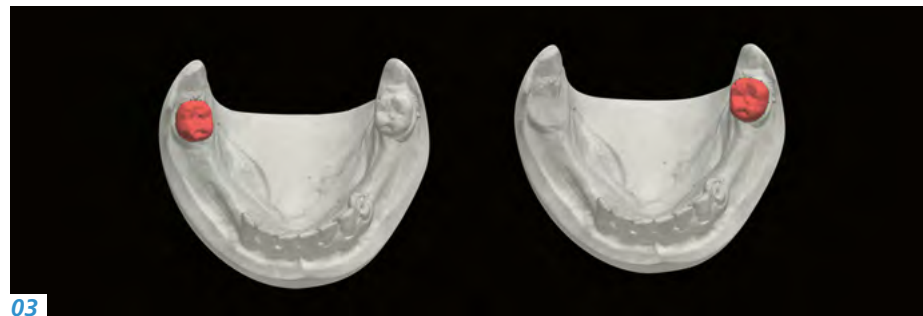
02

02 — Severely damaged remaining teeth

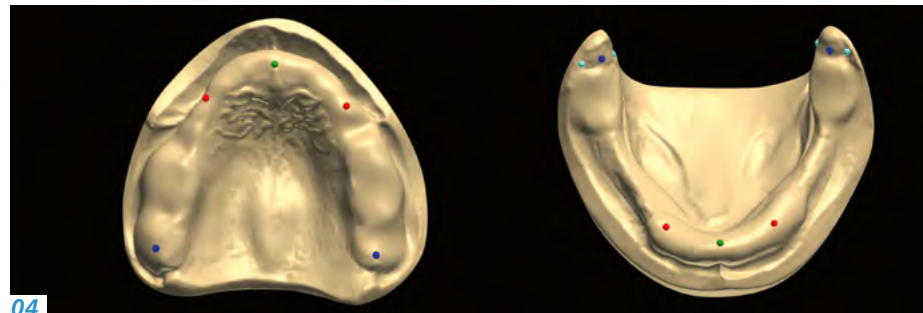
03 — Virtual extraction of the existing teeth in the software

04 — Virtual model analysis

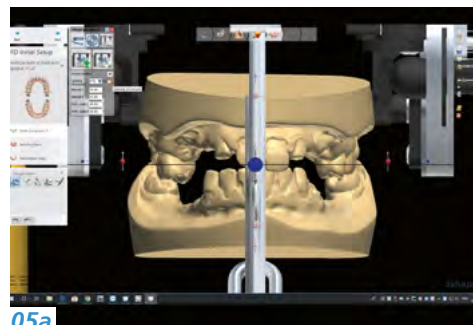
05 — Opening of the vertical dimension by 5.5 mm and selection of the tooth moulds in the Digital Denture Full Arch tooth library



03



04



05a



05b

suffered numerous oral infections. Over the years, Andrea had to take “countless” courses of antibiotics, the effectiveness of which diminished over time. As a result of these infections, several teeth had to be extracted. Andrea’s grave oral health situation interfered with her ability to eat.

The unattractive appearance of her teeth profoundly affected her emotionally. Her mental health and her self-concept suffered as a result. She described her previous dentist visits as “horrendous” experiences. Therefore, she was initially reluctant to agree to the suggested complex treatment. However, we were able to convince her of the necessity of the procedure in the course of very caring and empathetic conversations.

Treatment goals

After many discussions, an initial treatment goal was defined: The teeth that could not be saved would be extracted and an interim denture would be fabricated as a temporary solution. In a treatment second phase, implants would be placed. As a first prior-

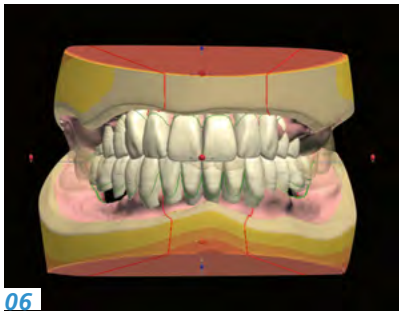
ity, however, we focused on improving the patient’s quality of life. We chose to use the Digital Denture process in order to offer the patient a “comfortable” treatment modality and ensure predictable results for the dental team. Since the patient did not wish to be toothless at any stage of the treatment, an interim denture had to be available at the tooth extraction appointment.

Treatment process

First of all, impressions of the upper and lower jaws were taken and the models were cast. Subsequently, the models were digitized with a laboratory scanner (3Shape). The data records were transferred to the Digital Denture software program, which allowed us to fabricate a set of tooth-coloured dentures with SR Ivobase® CAD and SR Vivodent® CAD Multi using an automatic manufacturing process.

CAD construction of the interim denture

Before the interim denture could be designed, the remaining teeth had to be removed from the virtual model (Fig. 3). For this purpose, the software program features a virtual extraction tool. The software guided us through the model analysis process, one step at a time. We marked the anatomical characteristics and established the significant parameters for the denture (Fig. 4). Based on the maxillomandibular relationship record, the vertical dimension was opened by 5.5 mm (Fig. 5a). Suitable tooth moulds were selected from the Digital Denture Full Arch tooth library (Phonares® II B71-L50-N3) (Fig. 5b).



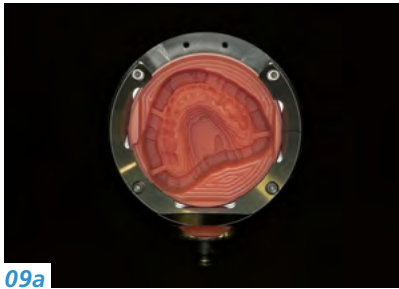
06 — The software automatically generates a set-up suggestion



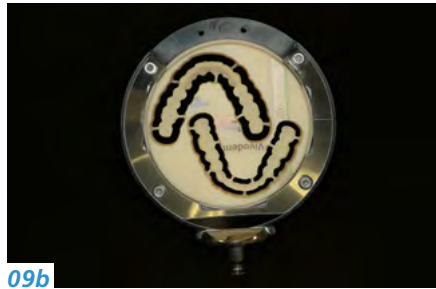
07 — The SR Vivodent CAD Multi disc is mounted with the labelling facing upwards



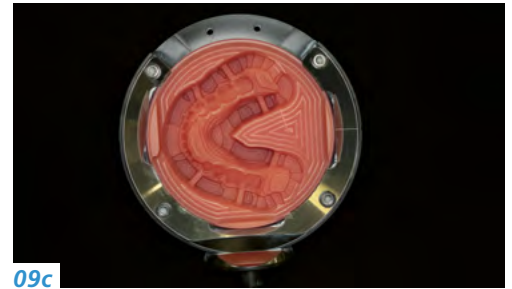
08 — The IvoBase CAD disc is mounted for the fabrication of the denture base



09a

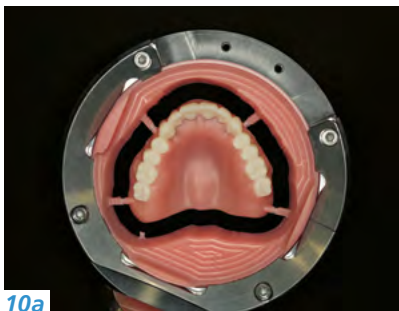


09b

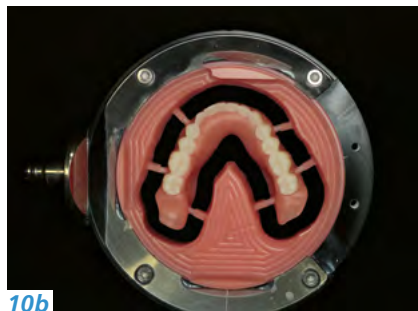


09c

09 — Roughly milled tooth arches and denture bases after the first milling cycle



10a



10b

10 — Upper interim denture after attaching the tooth arch to the denture base. The translucent properties of the incisal area are striking.



11

11 — The interim denture after the precision milling process

The software automatically generated a suggestion for setting up the selected teeth (Fig. 6). If desired, this set-up can be customized. Next, we checked the basic parameters (tooth length, midline, bite, etc.) and made the necessary fine adjustments in the software. In addition, we finalized the denture base and characterized the gingival contours. The software offers various tools for adding, removing or smoothing dental material.

CAM manufacturing of the interim denture

The CAD file was saved and the software generated a CAM output file for milling the dental arch and the denture base. The dental arch was milled from a biocompatible, highly cross-linked polychromatic PMMA-based DCL material (SR Vivodent CAD Multi) (Fig. 7). It is characterized by its special Pearl Structure Effect, which ensures an even progression of the shade. We selected shade A1. The multi-chromatic colour gradient of the disc – incisal, dentin, cervical area – imparts the milled monolithic teeth with a very natural looking appearance with very little reworking. The Digital Denture system incorporates a number of different gingiva coloured PMMA discs (IvoBase CAD). The shades of these discs are matched to those of the IvoBase denture base materials (preference Pink, Pink V, 34V) (Fig. 8).

The oversize process

In a first step, the CAM machine (PrograMill PM7) coarsely milled the dental arch. The dental arch was produced in oversized form and the base surfaces were exactly milled to fit the denture base (Fig. 9). In the next step, the tooth arch and the denture base were bonded together. An efficient, easy-to-use, self-curing two-component bonding agent was used (IvoBase CAD Bond) for this purpose (Fig. 9). The tooth arch and the denture base were finalized in the subsequent precision milling and finishing process (Figs 10 and 11).

Completion of the interim dentures

The digitally manufactured dentures required only minimal finishing. The morphology of the vestibular areas – a blend of



12

12 — The patient one week after the extraction of all her teeth and the immediate placement of the interim denture

13 — Impressive collage of before-and-after portraits of the patient. In a follow-up interview, the patient commented on the substantial improvement in the quality of life that the dentures had given her.



13a



13b



13c



13d

concave and convex areas – of the denture base had been saved to the software and then machined in a 1:1 ratio. At this stage, the microtexture of the teeth and the gingiva can be customized. Fine wear facets can be added if desired in order to enhance the lifelike appearance of the denture. In the present case, the denture was pre-polished with a dental handpiece and then polished to a final high gloss in a polishing unit, using pumice and a universal polishing paste and a cotton buffing wheel.

Tooth extraction and the new smile

The teeth were extracted under full anaesthetic and slight alveoloplasty was conducted. As a result, ideal conditions were created for the denture. The patient left the practice after the surgical intervention wearing the new interim denture. One week later she presented to the practice for a recall appointment. By that time not only her appearance, but also her demeanour had changed remarkably. She radiated vitality and self-confidence (Fig. 12).

Conclusion

The primary treatment phase represented an important part of the overall rehabilitation. The patient obtained a beautiful smile and a measurably improved quality of life (Fig. 13). Due to the Digital Denture system, the treatment required relatively little time and effort. Today, the young woman is broadly happy, self-assured and motivated to take the next treatment step.



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Esthetic results even on discoloured substructures



Value and brightness control with the IPS e.max system

By Dr Tony Rotondo, Brisbane/Australia, and Szabolcs Hant, MDT, Perth/Australia

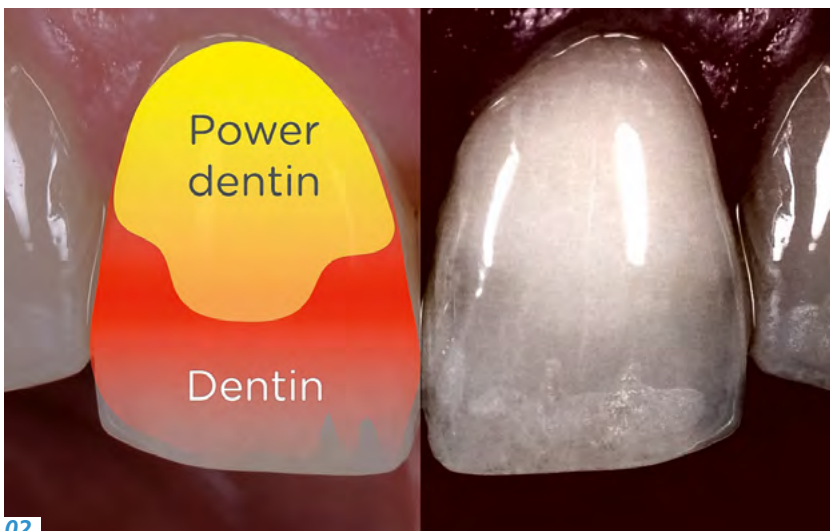
The correct brightness level is essential for the success of ceramic veneer restorations. This can be an issue, especially if discoloured preps are involved.

It is quite common for the prosthetic restorative team to be faced with discoloured preps, which, if located in the visible esthetic zone, require a well-considered approach. The question at the core is: How can we integrate the discoloured tooth structure into our layering work in a way that a balance between an effective “coverage” and a vibrant interplay of shades is achieved (Figs 1 and 2)? The approach outlined below is based on a clearly defined treatment itinerary consisting of the following stages:

1. Space requirement for masking with all-ceramic restorations
2. Material selection
3. Masking with framework
4. Masking with staining material (IPS Ivocolor®)
5. Layering with ceramic materials (IPS e.max® Ceram)



01



02

01 — These images highlight the inherent structure of natural teeth. It is the job of the dental technician to replicate these characteristics.

02 — To replicate the dentition in this case, Power Dentin is used for the opaque area and Dentin for the more translucent part.



03



04



05

- 03** — The metal core build-up is to be restored with a crown.
- 04** — The coping is first masked with one layer, in total with three layers, of IPS Ivocolor Essence White. Available space: 1.1 mm
- 05** — The metal post is effectively masked. The brightness and value of the crown blends in with the natural dentition optimally.

1. Space requirements for masking discoloured substrates with all-ceramic restorations

Sufficient space is essential to place all-ceramic restorations on discoloured preps if we want to mask the discolouration and attain a natural shade effect and the desired brightness (Figs 3 to 5). We can calculate the space required for the all-ceramic restoration with a formula proposed by Aki Yoshida and Galip Gürel as follows: We take the minimum thickness of an all-ceramic framework and add 0.15 mm by every shade we want to increase the brightness.

For example:

- Discoloured prep: shade A4
- Goal for the final crown: A1
- Minimum thickness of IPS e.max Press: 0.4 mm
- Space required for the restoration: $4 \times 0.15 + 0.4 = 1 \text{ mm}$

Another method is to use the SNA app (IPS e.max Shade Navigation App). This app establishes the translucency and shade based on the starting situation.

2. Selecting the framework material

Our material of choice has been IPS e.max Press for the past twelve years and we have had excellent experiences with it. We usually use the MO 0, LT and MT press ingots. If we happen to use the LT ingot, we always select an ingot that is one shade brighter for the framework, for example a BL4 for a final A1 shade. This is discussed in more detail in the section on "Layering" below. Under normal circumstances,

these ingots are ideal. However, if the prep is severely discoloured, the situation is more complicated. In these cases, the discoloured tooth structure must be disguised.

We differentiate between two methods for masking:

- Masking with the framework
- Masking with staining material (IPS Ivocolor)

3. Masking with framework

If the framework is used to mask the discoloured tooth structure, the options are limited. The masking capabilities will depend on the thickness of the framework and not only on the material chosen. MO ingots can easily block out discoloured substrates if they are used in an adequate thickness of 0.5 to 0.7 mm. In many cases, however, there is not enough space or the shade of the prep is too dark. Another method is to use HO ingots or zirconia frameworks for masking. However, these materials are extremely opaque, making it hard to create a natural illusion of depth and translucency in the incisal area.

4. Masking with staining material (IPS Ivocolor)

The Ivocolor range of stains and glazes includes some amazing materials. Given their unique properties, the Enamel and Effect materials are suitable for both metal-ceramic and all-ceramic restorations. Another advantage we like is the low firing temperature. The low-fusing Glaze and Essence materials helped us many times to adjust a contact point or to add more chroma and effects at the correction firing, without compromising the shape or texture.

We need a framework to use this technique. Any framework material will do in conjunction with the IPS Ivocolor range. Initially, we always used the MO 0 ingots. Then we realized that the LT and MT ingots generate similar masking effects, whilst providing superb full-contour lingual surfaces. IPS Ivocolor Essence White can be easily used as a basic white stain (Figs 6 to 9). We fire three separate layers because one thick layer can shrink too much during the firing process, causing uneven surfaces and cracks from the shrinking. With three layers of IPS Ivocolor Essence White, even severely discoloured areas can be masked without reducing the space required for the layering. These three layers of staining material are usually only between 0.1 and 0.15mm thick. Other Essences can be added to the basic white stain to achieve an even closer match to the final shade. In so doing, however, you should bear in mind that the more translucent materials you mix in, the less effective the masking effect is. For example, IPS Ivocolor Essence Cream contains translucent particles that reduce the opacity of the mixture. If you are not sure about the level of opacity you are getting, you can dilute the mixture with stain liquid or benzyl alcohol and then check

with a magnifying glass (10 to 20-times magnification). We normally use IPS Ivocolor Essence Sunset to add chroma to the white stain. Alternatively, you can also just use pure white at this stage and increase the chroma at the next stains firing. Stains are fired at a firing temperature of 750°C using the dentin firing program.

5. Layering with IPS e.max Ceram

Layering is also an important factor to cover discoloured preps and to achieve a high level of brightness and chroma. Originally, the IPS e.max layering ceramic was developed for opaque, high value framework materials, such as the HO and MO ingots and the first generation of zirconia materials. On these high-value frameworks, IPS e.max Ceram worked beautifully. Problems started to arise when the LT and HT ingots were introduced. How could you combine the translucent IPS e.max Ceram layering ceramic with the translucent LT and HT framework materials? All of a sudden, the usual layering technique did not work any longer, leaving dental technicians confused and frustrated – and so were we. Then we discovered the key element for successful restorations: brightness-value-opacity. We learned a great deal by experimenting with different combinations of materials. For some time, our principle has always been to use Mamelon Light Impulse – a material that features a high level of opacity and fluorescence and goes a long way towards achieving a lifelike result. In the meantime, the IPS e.max Ceram system has been extended to include the new Power Dentin and Power Incisal range of materials. These materials allow users to achieve a natural opacity without mixing different materials. If the framework is white and/or opaque, the first generation of Deep Dentin/Dentin/Incisal materials can still be used. If the frameworks are made of LT, MT or other translucent material, the new Power materials are used best (Figs 10 to 14).



06



07

06 — This case also involves a severely discoloured prep.

07 — LT framework masked with IPS Ivocolor Essence White



08

08 — A photograph (polarizing filter) is taken at the try-in to verify the brightness.



09

09 — Both crowns in situ



10

10 — In this case, the discoloured prep is to be restored with a crown and the adjacent tooth with a veneer.

11 — Dental photographs assist in analysing the initial situation.



11a



11b



12

12 — The frameworks have been pressed from a MT ingot and masked with IPS Ivocolor Essence White.

13 — Try-in after the first firing

14 — Both ceramic restorations in situ



13



14

Conclusion

The correct brightness is essential for successful esthetic results. The framework material should be selected carefully, especially for all-ceramic restorations. With the IPS e.max system, this is relatively easy, even in difficult cases. It is advisable to first determine the shade of the preparation and the space available for the restoration and then select the framework material. The IPS e.max Shade Navigation app (SNA app) is a useful tool for dentists and dental technicians in doing this. With the above presented approach, we can restore most cases of severely discoloured tooth structure with ceramic restorations that harmoniously and smoothly blend in with the natural dentition.



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