REFLECT MAGAZINE 10 YEARS

REFLECT

2/14

Making the case for an "occlusal airbag"

Restoration of a posterior tooth in two parts

An ideal symbiosis

CAD/CAM manufactured lithium disilicate hybrid abutment

What happens after pressing?

Characterization of a monolithic restoration with the IPS e.max system

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Dear Readers

I am proud to be writing the Editorial for the 10th Anniversary Issue of Reflect. I remember "when" Reflect was started and "why" it was started. When it was started is clear and measurable. Why Reflect was started is in a way just as clear. Reflect began because of you, and its success is based on you. In my Editorial on this special occasion I will discuss the goals of Reflect and how this magazine is a reflection of you.

Reflect began as a vehicle to bring your comments, your ideas and your dentistry to the dental professional audience. The authors are comprised of leaders in dentistry and dentists and technicians who simply want to share experiences with the readers. Reflect also has a goal to bring current topics and issues to the attention of our readers. The issues can be technology related, technique related or of a scientific nature. The common element is that each is contemporary and compelling. Reflect will publish articles featuring the most current technologies practiced by dentists and technicians in cases to be found in a normal practice. In other words, our authors are both practicing dentists and mentors with a commitment to communication and education. Over the years you have read articles on esthetics, adhesion, material science, polymerization technologies and simple but innovative, time-saving accessories.

During the last ten years the profession has changed in many ways. The most important of these changes have been described in the numerous articles published in Reflect. Perhaps the most noticeable and impactful change is the advancement of new technologies. New chemistries have made prevention more effective and the promise of caries reduction more realizable. New restorative materials allow the dentist to complete a restoration in less time with the quality required by the dental professional and the patient. The development of digital technologies is changing impressions, radiographs, practice and lab communication and the fabrication of crowns and bridges. Digital is changing dentistry in many of the same ways that it changes our lives on a personal basis. Digital can make processes easier, better and faster.

In this issue of Reflect we present articles on a new crown and bridge technology that is the result of the combination of innovative material technologies and innovative process technologies. The technologies are complicated but the result seems simple. We call it monolithic. Using either CAD/CAM technology or pressing technology, it is now possible to produce a crown or bridge from one material with natural esthetics and high strength, but without metal and without layering. This is another major step in the progress of our dentistry.

For the past ten years this magazine has been a reflection of our industry and readers. It has endured because it is committed to presenting the most important topics by the most important authors. We are proud to have been able to publish these articles and to support you, our customers and readers.

It is with pride that I invite you to enjoy this Anniversary Issue of Reflect.

Best wishes

Robert A. Ganley
CEO Ivoclar Vivadent

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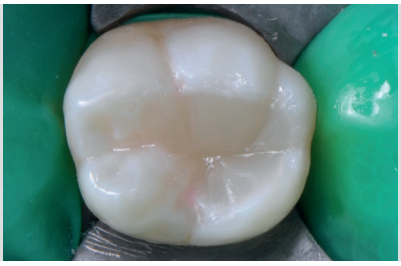

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Take advantage of the versatile options offered by digital magazines for tablets and experience the iPad edition of the article: "An ideal symbiosis: implant prosthetics and all-ceramics" by Dr Stavros Pelekanos, Nondas Vlachopoulos and Dimitris Varvatakos (pp. 16-19). Benefit from the interactive photo sequences with additional pictures, and learn more about the products used and the authors.

The availability of certain products can vary from country to country.

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Reflect celebrates its 10-year anniversary

Interview with Josef Richter, Chief Sales Officer, Ivoclar Vivadent

Ten years ago, Reflect magazine was published for the first time. Today, it ranks among the highest-circulation dental publications. The magazine's concept is straightforward: It offers dental professionals a platform to present in detail their treatment solutions using Ivoclar Vivadent products.

On the occasion of its 10-year anniversary, the editorial team spoke to Mr Josef Richter, Chief Sales Officer at Ivoclar Vivadent and intellectual father of Reflect, about the magazine's beginnings, its development and its future.

Mr Richter, you brought Reflect magazine into being. How did it all start?
It all started with customers asking for a medium which would allow a professional and interdisciplinary exchange of ideas. They suggested that Ivoclar Vivadent provides a platform to promote the professional exchange of clinical and technical day-to-day experiences. Then, and as I believe even today, customers were particularly interested in treatment solutions of individual patient cases, especially when complications had to be overcome. Furthermore, the readers continue to be interested in learning more about the potential of materials in successfully mastering the various restorative and prosthetic challenges – all for the benefit of the patient.

How was the first edition received by its readers?
At that time, it was rather unusual for a manufacturer of dental materials and equipment to publish a primarily scientific and factual magazine on its own initiative, because this would prevent the publication from being impartial. As a result, the first edition was received very critically and cautiously.

Since then, approximately 200 user reports from authors throughout the world have been published. How is the magazine positioned today?
In my opinion, Reflect has evolved into something more than just a prestigious dental magazine. It has established itself as a reference medium for dentists and

dental technicians who would like to call attention to their work in order to discuss their approach with their colleagues and enter into critical debate. When visiting the different markets, I am often asked to assess the work of dentists or dental technicians who believe that their work might represent a "best practice" example of a successful restoration or prostheses, which would be worth publishing in Reflect.

"Reflect has established itself as a reference medium for dentists and dental technicians."

Unfortunately, I have no or only limited influence on the articles which will be published in the magazine due to the fact that I am neither a dentist nor a dental technician and therefore lack the ability to pass a qualified judgment. Furthermore, I am not a member of the editorial team – simply because I am working in sales and not in the scientific sector. This proves again that Reflect is generally not a commercial medium, which might be the reason for its popularity among dental professionals.

The name "Reflect" has a double meaning: "to think about" and "to mirror". Has the name been deliberately chosen based on this double meaning?

Yes, exactly. Even the best result can motivate someone to further improve certain things next time. Nature is so fascinating because it can be imitated in so many different ways. Dental professionals who look at their completed work, who examine it and who reflect on it will surely ask themselves this one question: How can I succeed in better imitating nature next time? This question can be debated with colleagues in the field – and the publication of a patient case provides the basis for such intensive discussions.

An anniversary not only presents the perfect occasion for a review of the past but also for a look into the future. Which trends will leave a mark on the dental market and which types of user reports will dominate Reflect magazine in the future?

The ongoing boom in the area of digital technologies, i.e. the "digital workflow", is currently the centre of attraction on the dental market. Most likely, we will see an increasing number of articles on the processes and the materials used in digital workflows. Furthermore, I expect that the subject of a monolithic approach, i.e. the fabrication of prosthetics or restorations made of one piece, will increasingly be presented in the publication. Articles focusing on the clinical use of individually fabricated abutments will also be given special attention.

You have been involved in the dental sector for more than 20 years. What attracts you personally to this industry?

Actually, the dental sector has been home to me for even a little longer. However, I try to make light of this as I do not want to be counted among the industry's old dinosaurs yet! I feel privileged to be pursuing an occupation which serves the health and well-being of people. Firstly, dentistry is able to help human beings to solve dental-related problems and secondly, to regain their sense of well-being and natural vibrancy to a large degree. It makes me feel very good to be able to provide the high-quality materials and equipment required to achieve all of this.

Thank you very much for the interview, Mr Richter.

Foundation for effective collaboration

Photographic communication between dentist and dental technician

Prof. Dr Daniel Edelhoff, Munich/Germany

In addition to a bite registration, facebow transfer and impressions, intraoral and extraoral photos form the most important key in the communication between dentist and dental technician.

The importance of photographic communication is particularly significant if the dentist and dental technician collaborate with each other from distant locations and have to fulfil demanding esthetic and functional requirements. Photos are not only used for the initial transfer of information to conduct an esthetic and functional analysis on the basis of a wax-up, but they also play a significant part in many other steps of the restorative process, such as in the clinical evaluation of the proposed restoration (mock-up) and in the shade selection of the tooth and preparation.

Adequate photographic equipment is an indispensable tool for the teamwork between dentist and technician.

Fig. 1 A portrait photo of the patient with the facebow in place gives the dental technician valuable information on the position of the bipupillary line in relation to the occlusal plane.

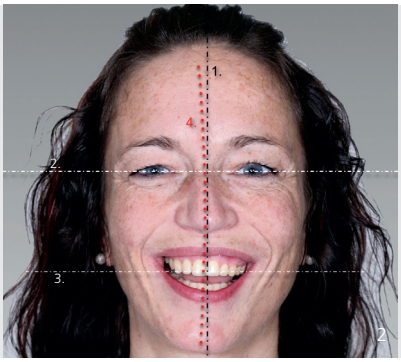

Fig. 2 A portrait photo showing the patient with a full smile is used for analysing basic esthetic parameters: 1. centre line, 2. bipupillary line, 3. occlusal plane. The patient presented in this case shows asymmetries in the area of the facial midline (4.), gingival contours and the occlusal plane/buccal corridor.

Fig. 3 Frontal view of the upper anterior teeth. An autoclavable black contrastor was used to obtain a more detailed picture of the morphological structures (Flexipalette, www.smileline.ch).

Fig. 4 Frontal view of the upper anterior teeth. To facilitate the analysis of the internal structures, it may be useful to take an additional picture using a cross-polarization filter to eliminate all reflections (polar_eyes, www.finest-dental.de).

Fig. 5 Shade selection with a gingival mask including a white balance and grey card (modified according to MDT Otto Prandtner). The shade tabs of the A-D shade guide may be fitted in the gingival mask and photographed together with the relevant tooth regions at the beginning of the treatment (Gumy, Shofu, Art. PN 7040).

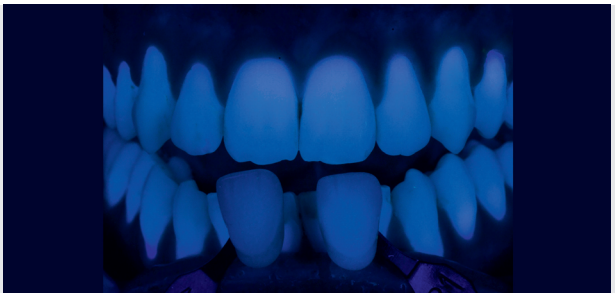

Fig. 6 For fine tuning the intensity of the tooth's fluorescent level, additional pictures using a UV light source may be useful and may be referenced with shade tabs (fluor_eyes, www.finest-dental.de).

Scope of photographic documentation

To be able to obtain a detailed impression of the clinical situation at hand, dental technicians should receive a comprehensive photographic portfolio comprising the following shots:

1. Portrait photo of the patient with the facebow (Fig. 1)
2. Portrait photos showing the patient with relaxed lips, with a light smile and with a full smile (Fig. 2)
3. Intraoral photos from the anterior front, lateral left and lateral right in static and dynamic occlusion with special focus on the area in need of treatment (Figs 3 and 4)
4. Intraoral photos from the occlusal showing the complete upper and lower jaw

Shade selection

Before the teeth are prepared, shade selection should be performed (e.g. with an A-D shade guide) (Figs 5 and 6). It is essential to clearly define and agree with the patient on the final tooth shade. If any tooth whitening procedures have been carried out, they should be completed by this stage. Generally, the brightness value has a more decisive effect than the tooth shade proper on the final outcome. If the patient cannot clearly decide between two brightness values, selecting the brighter version of the two is advisable. In case of doubt, the dental technician will be able to decrease the brightness value later on, if need be. Conversely, if the brightness value turns out to be too low, it is virtually impossible to increase it at a later stage by using stains. It is essential to take a picture of the closest shade sample (reference shade) together with the remaining dentition. If translucent restorations are created, it is also important to include a die shade guide (IPS Natural Die Material) to enable the dental technician to manufacture laboratory dies in a matching colour (Figs 7 and 8).

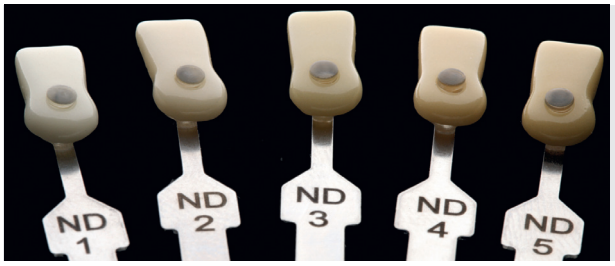

Fig. 7 Various shade samples of the IPS Natural Die Material shade guide

Fig. 8
Selecting the shade of the severely discoloured central incisor after preparation for a full wrap veneer

Conclusion

High-quality photographic documentation (Fig. 9) provides an indispensable basis for the successful collaboration between the members of the restorative team and provides a high level of predictability with regard to the clinical result.

Fig. 9 Professor Edelhoff during intraoral photography

Acknowledgement

I would like to thank Oliver Brix for providing the dental lab pictures.

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Making the case for an "occlusal airbag"

Restoration of a posterior tooth in two parts

Dr Knut Hufschmidt, Wels/Austria

The benefit of fissure sealing in molars, premolars and deciduous teeth is a topic of ongoing debate. This article highlights the need for effective protection.

Sealing the fissures of permanent molars and premolars and of deciduous teeth continues to be a contentious subject. Nevertheless, within the framework of a sound preventive treatment strategy, fissure sealing represents a state-of-the-art solution for maintaining a caries-free dentition. On the basis of a clinical example, this article makes the case for protecting a few teeth too many than a few too little with this non-invasive treatment modality. Fissure sealing is pain-free, affordable and highly effective in the long term. These reasons should outweigh any concerns about "overtreatment". Incipient caries can damage the tooth structure and the pulp. In the worst case scenario, the tooth may have to be extracted.

Case history

The twelve-year-old patient presented to our practice for the first time in December 2013. At that time, she came for a routine examination. The panoramic radiograph taken during this appointment revealed a mixed dentition typical for the patient's age. The X-ray clearly showed caries in tooth 36 (Fig. 1). All the permanent teeth including the wisdom teeth were completely formed. During the clinical inspection, discolouration was identified around the fissures of tooth 36 (Fig. 2). All the other teeth were free of caries. The clinician who had previously treated the patient had not sealed the occlusal surfaces.

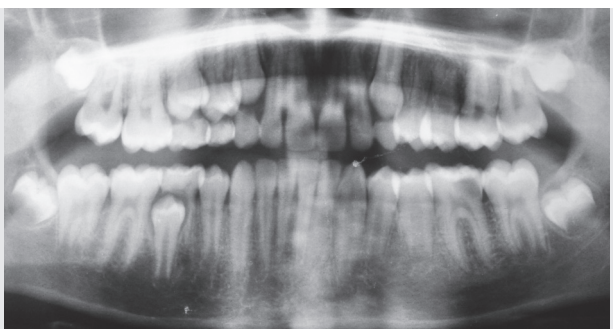

Fig. 1 Preoperative situation: The lesion in tooth 36 is clearly visible on the X-ray. The remaining mixed dentition is caries free.

Fig. 2 Clinical preoperative view: Discolouration in the fissure of tooth 36 (occlusal caries)

Fig. 3 Establishment of a dry working field with a rubber dam

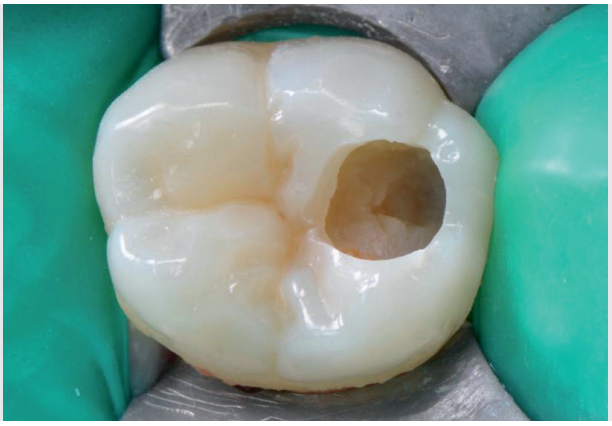

Fig. 4 Creation of the cavity to gain access to the caries

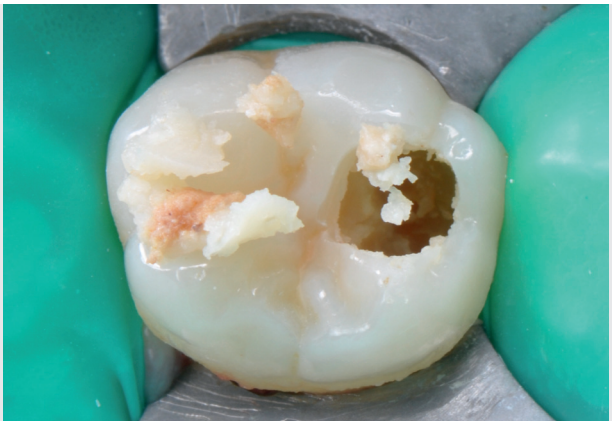

Fig. 5 Caries excavation

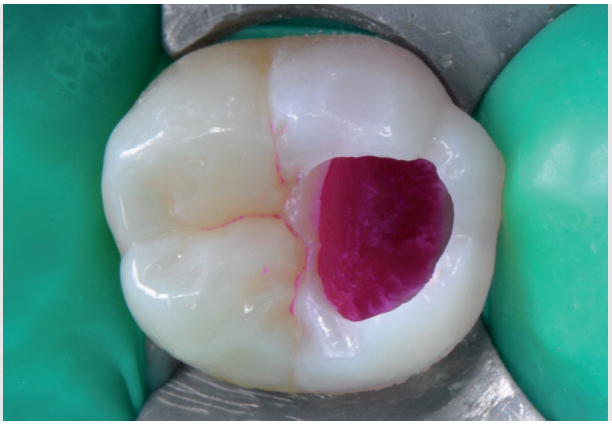

Fig. 6 Staining of the carious parts with a caries disclosing agent

Tooth 36 reacted sensitively to the pulp vitality test. The percussion test did not reveal any irregularities. The young patient and her mother were informed about the large size of the lesion and its proximity to the root canal as well as about the possible necessity of root canal treatment. The aim was to excavate the caries, fill the tooth using minimally invasive methods and keep the tooth alive in the process. Due to the urgent nature of the case, an appointment was made for the immediate future.

Minimally invasive treatment of tooth decay is of utmost importance in preventive restorative therapy. The adhesive technique and the corresponding filling methods involving materials such as the composite resin Tetric EvoCeram® Bulk Fill, which was used in this specific situation, provide the clinician with optimal tools for this task.

Caries excavation

Since the young patient had not undergone any significant dental treatment previously, she was given a nerve block anaesthetic in order to ensure an uninterrupted and stress-free treatment session. A rubber dam was placed to give optimum access to the cavity and to keep the working field completely dry (Fig. 3). As a result of the extensive occlusal lesion, which is visible in the X-ray, a relatively large opening was created to gain access to the cavity (Fig. 4). The picture that was presented was typical of hidden caries. The affected dentin, which was extremely soft, was roughly removed with a hand instrument (Fig. 5). In the present example, the enamel surfaces had already been undermined to a large extent. When a minimally invasive approach is taken, the area that needs to be treated is often difficult to see. In order to ensure the complete removal of the infected tissue in this tooth, therefore, the access opening to the cavity was enlarged and the carious dentin structure was stained with a disclosing agent (Fig. 6).

Two-part filling treatment

In the present case, it was possible to preserve the distal enamel wall of the affected tooth. The minimally invasive treatment composed of caries removal and tooth filling involved two parts. The first part focused on completely removing the carious tissue adjacent to the distal enamel wall. All the carious tissue had to be carefully removed at the enamel-dentin junction without perforating the enamel tooth structure. Once this treatment step had been successfully concluded (Figs 7 and 8), the ultra-thin enamel wall was acid etched and then reinforced using a dentin adhesive (Syntac® Classic) and a flowable composite (Tetric® EvoFlow) (Fig. 9).

The second part of the treatment concentrated on the excavation of the carious dentin near the pulp. Utmost care had to be taken not to open the pulp cavity (Fig. 10). Therefore, a caries disclosing agent was also used to stain the affected dentin tissue, which was then very judiciously

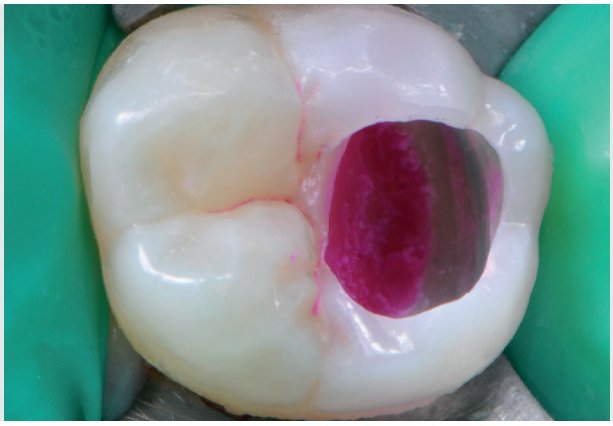

Fig. 7 The distal wall is free from caries.

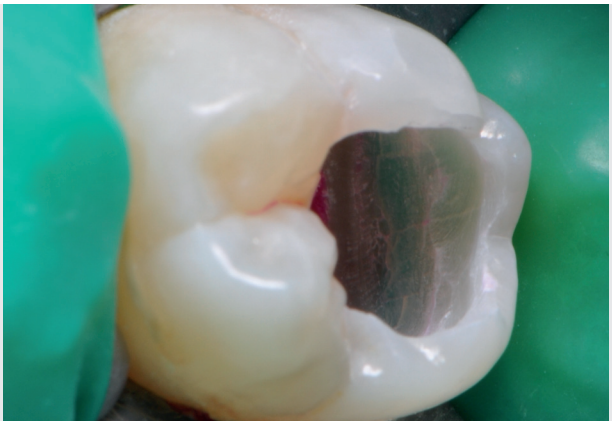

Fig. 8 Intact, ultra-thin distal tooth side

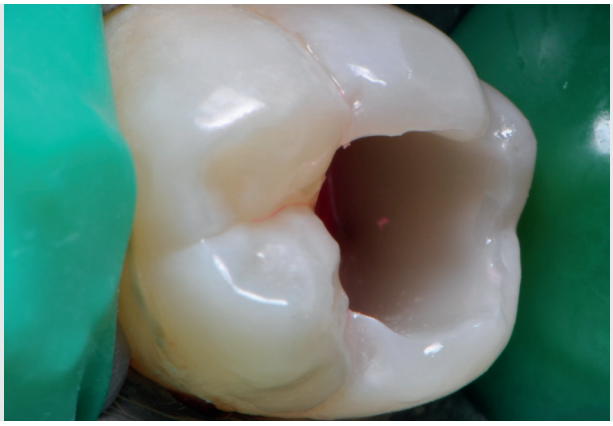

Fig. 9 The distal tooth side has been reinforced with a flowable composite.

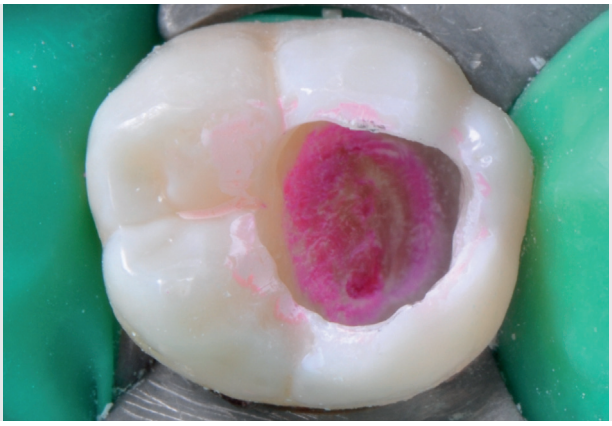

Fig. 10 Concentration on removing carious tissue near the pulp. The highest priority was to preserve the vitality of the tooth.

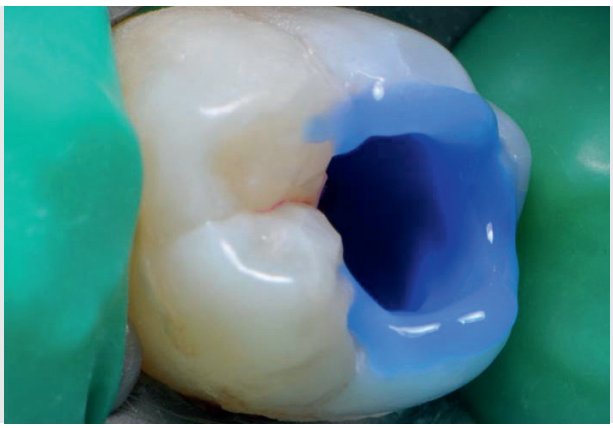

Fig. 11 Enamel etching with phosphoric acid (30 seconds)

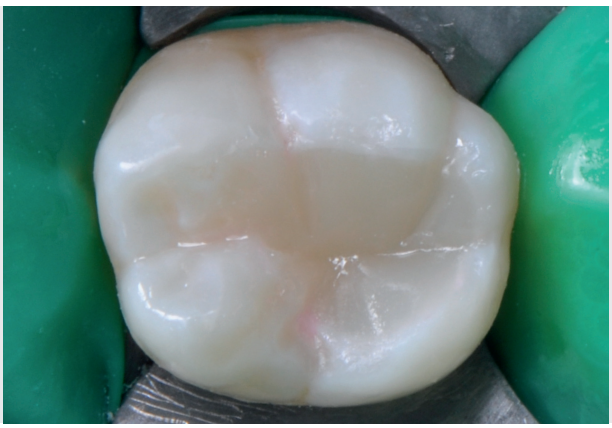

Fig. 12 Restored tooth 36. A bulk-filling composite (Tetric EvoCeram Bulk Fill) was used. The original tooth shape has been restored.

removed to prevent pulp exposure (Pulpa aperta). Even minimal opening of the pulp could have endangered the vitality of the tooth and entailed root canal treatment.

Creating an impenetrable, tight and intact restoration is more important than ensuring the complete removal of carious tissue.

Bulk-fill restoration

The quality of the restorative treatment not only depends on the proper preparation of the tooth, but also on the appropriate choice of the filling material and a precise working protocol. After the caries had been excavated in this case, tooth 36 was restored with the direct bulk-filling technique using Tetric EvoCeram Bulk Fill. This nanohybrid composite is easy to sculpt and contour. The restorations are esthetic due to the material's lifelike translucency and shade. According to the manufacturer, a polymerization booster named Ivocerin® has been incorporated into the material. As a result, the composite resin can be completely

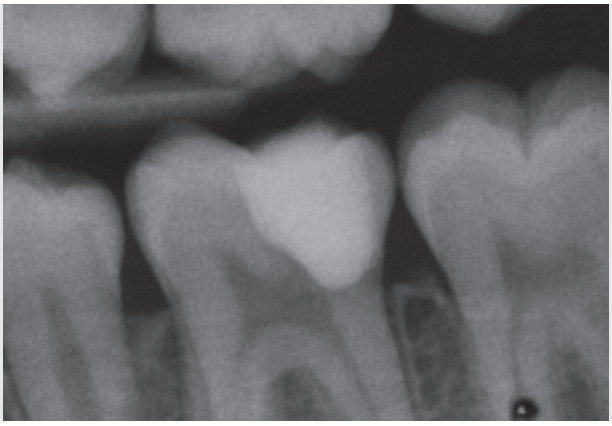

Fig. 13 Postoperative X-ray: The distal enamel wall has been preserved.

Fig. 14 Clinical postoperative picture: The fissures of the adjacent teeth have been sealed with Helioseal Clear to protect them against caries.

polymerized in increments of up to 4 mm thickness within 10 seconds. In addition, a special shrinkage stress reliever in the material reduces shrinkage stress to a minimum. This composite resin is very interesting for practitioners due to the efficiency and reliability of the bulk-filling technique. Nevertheless, adhesive restorations are technique sensitive and should be placed with due care.

In the situation at hand, a distance of 7 mm was measured between the deepest point of the cavity and the occlusal marginal ridge using a periodontal probe. In the first filling step, the cavity was conditioned with phosphoric acid. For this purpose, the acid was selectively applied along the enamel margin (Fig. 11). After 15 seconds, the entire dentin surface was coated with etching gel. The acid was left to react for another 15 seconds. Next, the dentin adhesive (Syntac Classic) was applied, followed by the first composite (Tetric EvoCeram Bulk Fill) increment in shade IVA (universal A shade). The remaining depth of the cavity now measured about 4 mm. The composite resin was polymerized for 10 seconds with Bluephase® G2. Then, the second increment was placed. The cavity was filled completely and the chewing surface of the tooth was contoured. The excellent moulding properties of the material allowed a functional and natural-looking restoration to be efficiently produced. The restoration was polymerized for a final 10 seconds.

Finishing

Before the rubber dam was removed, a scalpel was used to roughly remove the excess material at the filling margins and a Soflex disc was used for finishing the restoration. Then, the surface was polished with silicone polishers (Fig. 12). The rubber dam was removed and the occlusal and laterotrusive movements were checked and the necessary adjustments were made.

A direct comparison of the preoperative situation (Fig. 2) and the completed restoration clearly shows that the original tooth shape and the anatomic features of the chewing surface have been restored in accordance with the original appearance of the tooth. The X-ray of the final situation shows the tight radiopaque filling close to the pulp (Fig. 13). All the other proximal surfaces are free from carious lesions. In order to prevent the occurrence of further occlusal surface caries, all the erupted molars and premolars were sealed with Helioseal® Clear (Fig. 14).

Conclusion

The present case once again highlights the importance of sealing the occlusal surfaces for preventive reasons. Furthermore, direct composite restorations have become indispensable in the treatment of carious lesions according to minimally invasive methods. The adhesive approach is today's preferred technique for repairing small and even some largish defects. The adhesive technique is versatile, allows maximum preservation of the tooth structure and stabilizes the affected tooth. In situations, where a considerable amount of tooth structure has been lost, the efficient bulk-filling technique provides an economical solution. The polymerization booster contained in the material used to treat our patient minimizes the risk of obtaining inadequate polymerization results. Fillings in very deep cavities can be effectively and reliably cured. In terms of their appearance, modern bulk-fill materials are just as esthetic as their traditional hybrid composite counterparts due to their excellent ability to blend in with the natural dentition.

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Methodological restoration of function and esthetics

Complex restorative procedure involving all-ceramic IPS e.max Press crowns

Dr Sergey Chikunov, Moscow/Russia

Establishing the proper function of the teeth is the key to producing long-lasting prosthetic results. In difficult cases in particular, a well-thought-out plan is essential for restoring the harmony of esthetics and occlusion.

It is a considerable challenge to treat a patient with dysfunctional teeth. The dental team is faced with the complex task of having to stabilize the occlusion, adjust the vertical dimension and restore the esthetic appearance of the teeth. In the process, biological aspects have to be taken into consideration and the appropriate materials have to be selected. In the described case, the dentition of the patient was restored according to a sophisticated and well-thought-out treatment plan. After the successful functional therapy, the patient was fitted with all-ceramic crowns (IPS e.max® Press).

Case study

The existing prosthetic restorations of the 55-year-old patient were in a dismal state. The teeth of the patient had been restored with crowns, some of which had been placed on implants. Both the function and the esthetics of the patient's teeth were impaired. The patient complained about not being able to chew properly and experiencing muscle tension. He felt inhibited by esthetic and phonetic problems. In addition, some of the ceramic crowns had fractured and showed chipping. The patient wished to have the situation improved without any surgical interventions (explantation).

1a

1b

Figs 1a and b
Preoperative situation: The extraoral pictures of the patient profile showed the reduced vertical dimension.

Fig. 2 Intraoral diagnosis: severe gingival recession around the existing ceramic restorations

Fig. 3 The occlusal surfaces of the ceramic crowns did not enable the patient to chew properly.

Fig. 4 The posterior implants were exposed.

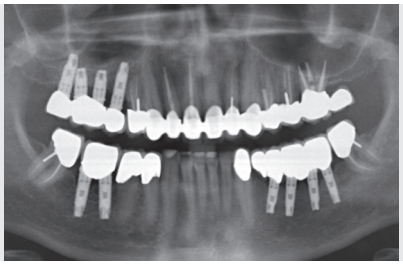

Fig. 5 Preoperative X-ray showing inadequate root fillings, bone atrophy around implants and a questionable number of implants

Intraoral and extraoral examination

The case was discussed very carefully with the patient. His dental history was recorded and the patient-related parameters were documented (by radiological, photographic and clinical means). The middle of the face looked slightly compressed. This was judged to be a sign of lost vertical dimension (Figs 1a and b). The drooping corners of the mouth when the lips were closed were a further indication of this condition. The intraoral analysis revealed signs of gingival recession, inadequate clearance in the centric occlusion and poor fit of the restorations (Fig. 2). The patient had been treated with joined PFM crowns, some of which were supported by natural tooth abutments and others by implants. The incisal edge of the crown on tooth 22 was chipped. The occlusal morphology of the posterior crowns did not show any functional design; the flat occlusal surfaces did not allow the patient to chew properly (Fig. 3). The clinical analysis revealed poor support in the posterior region and a lack of anterior-canine guidance. Furthermore, a transverse discrepancy between the upper and lower jaw was identified. The bone and soft tissue had visibly deteriorated in the areas around the implants (Fig. 4).

Diagnosis:
- Angle's Class I malocclusion on the right
- Angle's Class III malocclusion on the left
- No centric stops in the posterior region
- No anterior-canine guidance

The radiological examination showed that the root fillings were inadequate (Fig. 5). In addition, our worst concern was confirmed: The bone structure around all the implants had deteriorated. The appropriateness of the number of implants that had been placed in the past was just as debatable as their positioning in the bone.

Functional analysis

A clinical functional analysis was performed in order to evaluate the functional condition of the mouth, that is, the relationship between the muscles, teeth (restorations) and the temperomandibular joint, and therefore to identify any dysfunctions. The masseter (cranial), medial pterygoid and mylohyoid muscles and the maxillary tuberosity showed sensitivity to palpation. The muscles on both sides were very sensitive, which indicated a high level of activity of the protractor and the closing muscles. The patient also reacted to pain when the temperomandibular joint was palpated. The lateral poles were sensitive to pain when they were active and at rest, as were the cranial articular cavities (on both sides). In addition, the patient complained about chronic pain.

An instrumental functional analysis followed. The Axioquick® Recorder (SAM, Germany) was used to take axiographic measurements (Fig. 6). This ultrasonic system allows all the functional movements of the lower jaw to be efficiently and precisely recorded and analyzed in 3D. The axiograph in this case revealed that the starting point and endpoint of the opening and closing movements did not correspond. Furthermore, the presence of a reciprocal click in the left side of the jaw and a relieving posture were diagnosed. The movements of the temperomandibular joint were restricted. The cephalometric analysis confirmed the loss of vertical dimension (Fig. 7). The analysis showed a brachyfacial skeletal pattern with Class I malocclusion, a short face and malpositioned upper incisors (tilted towards the palatal aspect).

A dental cast analysis is indispensable in the preparation of a well-structured treatment plan.

The diagnostic models were mounted in the articulator (SAM 3) with the help of the Axioquick Transferbow (Fig. 8). The individual setup of the articulator was done with the Axioquick Recorder.

Functional treatment

A systematic treatment strategy was established after the dental cast analysis had been made. In a first step, the patient underwent occlusal splint therapy. The aims of this treatment were as follows: to align the upper and lower front teeth slightly towards the labial aspect; to restore the anterior-canine guidance; to build up occlusal support in the posterior dentition; to slightly enlarge the upper tooth arch and to increase the vertical dimension. The patient wished all his teeth to be esthetically restored with all-ceramic crowns.

The patient received a myopathic occlusal splint that increased the vertical dimension by 6 mm (Fig. 9). At regular intervals, the muscles were palpated and the device was monitored and adjusted. Once all the muscles had relaxed, we defined the reference positions, placed the models in the articulator and fabricated the wax-up. In complex treatment procedures of this kind, a wax-up is an indispensable component. It serves as a valuable tool in the communication with the patient and it helps to establish realistic goals which can be confidently pursued. After the occlusal splint therapy had been concluded, the existing restorations were removed.

Prosthetic treatment

Ancillary preventive measures are of utmost importance in any reconstructive treatment involving the restoration of lost vertical dimension. The situation has to be stabilized before restorative treatment (restoration of the vertical dimension and design of the occlusion) can begin. In our approach, the occlusal adjustments are only made once the splinting treatment has been successfully completed. Irreversible measures that are taken without any previous diagnostic steps or occlusal splint therapy represent an incalculable risk.

The dismal state of the patient's dentition became apparent when the crowns were removed. The quality of the restorations did not correspond in the least to the current dental standards. Several of the root fillings had to be replaced. Some of the post-and-core restorations also had to be renewed. In order for all-ceramic restorations to look natural, they have to blend in smoothly with the other features of the oral cavity. Therefore, the metal posts were built up with an opaque composite (Fig. 10) to impart the tooth cores with an optimal colour.

In the first step, ceramic restorations (IPS e.max Press) were placed on the anterior teeth and the premolars. Individual IPS e.max Press abutments were fabricated for the molars. Subsequently, full-contour IPS e.max Press crowns were placed on these abutments (Figs 11 and 12).

The monolithic technique of fabricating the restorations allowed maximum advantage to be taken of the high strength of the lithium disilicate material in the implant-supported molar region. Furthermore, this approach would prevent chipping and ensure long-lasting restorations. Highly esthetic results were achieved with skilful staining and glazing.

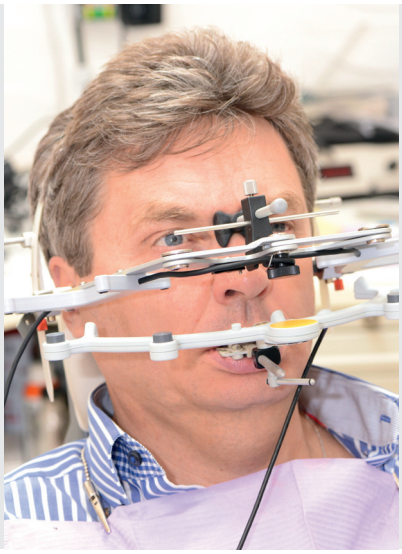

Fig. 6 Instrumental functional diagnosis by means of axiography

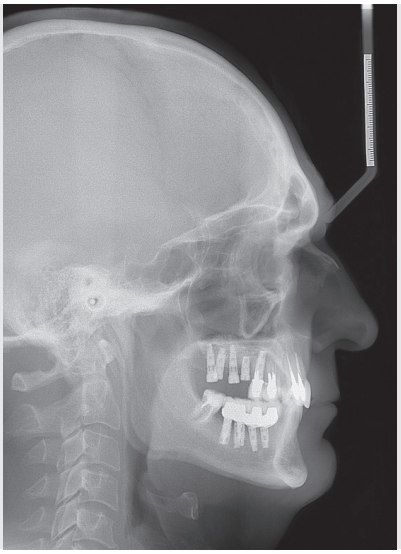

Fig. 7 The cephalometric measurements confirmed the loss of vertical dimension.

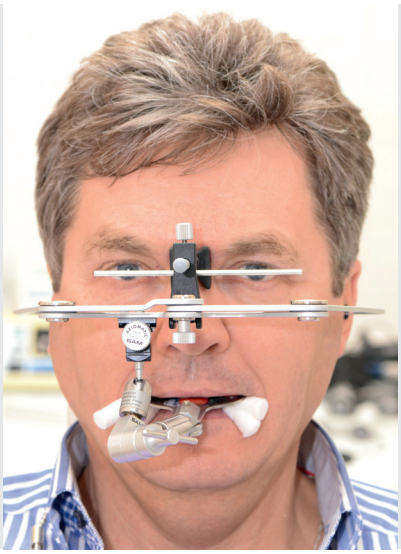

Fig. 8 The oral recordings were transferred to the articulator by means of a transferbow.

Fig. 9 The myopathic occlusal splint which increased the vertical dimension by 6 mm

Fig. 10 The prepared teeth before the permanent restorations were placed

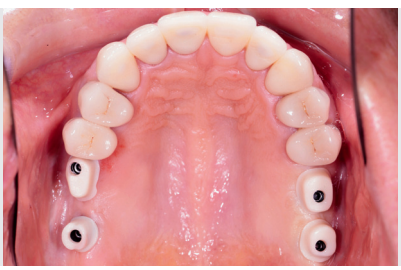

Fig. 11 The ceramic single crowns for the anterior teeth and the premolars have been seated. Individual ceramic abutments were created for the implants in the molar region.

Fig. 12 The seated restorations (crowns made with lithium disilicate, IPS e.max Press)

Fig. 13 The front view shows a functionally and esthetically successful result.

Fig. 14 Inspection of the laterotrusive and protrusive movements

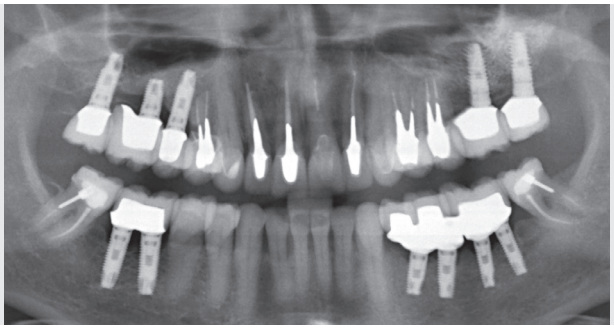

Fig. 15 Final X-ray: The inclination of the implants was also improved with the customized superstructures and crowns.

Fig. 16
"Esthetics follows function" – the soft tissue features of the centre part of the face have been considerably transformed by the increase in the vertical dimension. The facial expression of the patient reflects his satisfaction with the result.

The occlusal splint therapy allowed the patient to get used to the "new" vertical dimension. Therefore, he felt comfortable with the way in which the new restorations functioned (Fig. 13). Furthermore, an esthetically pleasing result was achieved. The situation inside and outside the mouth exactly corresponded to the wishes of the patient (Fig. 14). The final panogramic radiograph showed that the positioning of the implants had also improved during the treatment process (Fig. 15). Another possibility would have been to remove the implants. However, this procedure would have entailed the risk of bone loss. This treatment approach was not an option for the patient. At the subsequent routine recalls, no abrasion facets were identified on the restorations. The occlusal conditions remained unchanged. The diagnostic findings related to the temperomandibular joint and the chewing muscles did not reveal any irregularities. The patient was very pleased with the treatment result.

Conclusion

This case study illustrates the complex and time-consuming nature of the therapy required by a patient who had received inadequate treatment in the past. The treatment focused on restoring the function and the esthetics of the patient's dentition. After a lengthy occlusal splint therapy, the patient's teeth were restored with lithium disilicate crowns made with IPS e.max Press. The treatment approach of "esthetics follows function" also proved to be successful in this case (Fig. 16).

Acknowledgement

I would like to thank Oliver Brix for the excellent dental lab work.

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An ideal symbiosis: implant prosthetics and all-ceramics

CAD/CAM manufactured lithium disilicate hybrid abutment for the anterior region

Dr Stavros Pelekanos, Nondas Vlachopoulos and Dimitris Varvatakos, Athens/Greece

Implant-supported single-tooth restorations in the anterior region may be regarded as the supreme discipline of esthetic dentistry. A lithium disilicate CAD/CAM block with a premanufactured connection geometry that fits the titanium base significantly facilitates the prosthetic procedure.

Osseointegration is today no longer considered to be the only factor that determines the success of implant treatment. Esthetics and function play an equally important part. Naturally shaped gingival contours are particularly important in esthetically relevant areas. In this context, consistent teamwork is de rigueur. Using evidence-based treatment procedures and the "right" materials are also of importance. The patient case described below demonstrates the manufacture of a tailor-made lithium disilicate hybrid abutment (IPS e.max® CAD Abutment Solutions) for use in conjunction with an all-ceramic crown.

Preoperative situation

The patient visited the practice because she experienced problems with tooth 21, which had been endodontically treated and restored with a post build-up and crown. The gingival tissues surrounding the tooth were irritated and swollen (Fig. 1). The X-ray showed an incomplete obturation of the root canal and an apical radiolucency, which was indicative of an inflammation involving a radicular cyst (Fig. 2). The adjacent teeth had been adequately restored with crowns and bridges.

Consideration was given to both revision of the root canal treatment and tooth extraction during the diagnostic stage. When restoring a tooth in the esthetic region in particular, these two treatment options should be carefully evaluated against each other. Conservative treatment may lead to additional bone loss and may therefore result in a deterioration of the initial condition for a later implant treatment. We decided to extract tooth 21 and restore the gap with an implant-supported restoration because this option offered a better prognosis

Figs 1 and 2 The soft tissues around crown 21 were inflamed and swollen. The X-ray revealed an inadequate root canal filling and apical radiolucency.

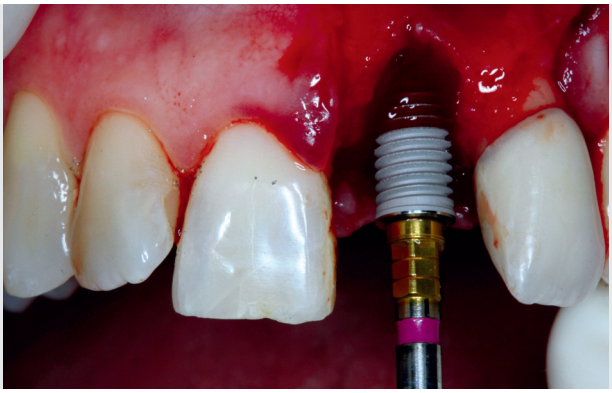


Fig. 3 Immediate implant placement after extraction of tooth 21, followed by guided bone regeneration (GBR)

Fig. 4 The patient wore a temporary bridge during the healing period. The situation was stable after six months.

than the revision of the existing root canal filling. Our focus was on preserving the alveolar ridge volume. Various treatment methods are available to minimize the anticipated bone defect after tooth extraction. Immediate implant placement was the method we chose for the case described here.

Extraction and immediate implant placement

After appropriate preparations had been made, tooth 21 was extracted atraumatically. The periradicular granulation tissue was carefully removed with maximum preservation of the facial soft tissue continuity. Meticulous transalveolar curettage of the granuloma was paramount to the success of the planned immediate implant placement. The implant (3i T3® Tapered, Biomet 3i) was inserted in line with the known principles of 3D implant positioning (Fig. 3). In accordance with the concept of guided bone regeneration (GBR), the bone was augmented with bone substitute material (Cerabone®, Botiss) and covered with a resorbable collagen membrane (Jason®, Botiss). A modified healing abutment was inserted for stabilization. The patient received a temporary bridge (pressure-free basal rest) and was sent home.

At implant uncovery six months later, the conditions were stable (Fig. 4). After removing the healing abutment (Fig. 5), we focused our attention on forming appropriate soft tissue contours. A screw retained temporary implant crown was placed to form the emergence profile in the region of tooth 21 in such a way that the final restoration would emerge from the alveolar ridge like a natural tooth (Fig. 6). To achieve this, the basal surface of the temporary crown was modified several times during the following months and the soft tissue shaped using gentle pressure.

Final restoration

A custom-made abutment was intended to form the mesostructure for the implant-supported crown. The circular emergence profile of the implant necessitates the use of an abutment that imitates the oval-shaped emergence profile of the dentogingival structures to obtain an anatomically ideal interface. A prefabricated abutment is in most cases inappropriate for this purpose. In addition to involving an esthetic disadvantage, these abutments may pose difficulties in cementing the superstructure in a controlled manner if a low-lying cement joint is present. By contrast, a custom-made abutment affords the opportunity to design an ideal transition between implant and crown. In this case, a two-part hybrid abutment involving an all-ceramic crown was created: the abutment was individually milled from a lithium disilicate block (IPS e.max CAD) and then cemented to a titanium base. In this way, the shape, emergence profile and esthetics can be accurately matched to the clinical situation. The ceramic structures can be manufactured from IPS e.max CAD blocks with prefabricated interfaces using CAD/CAM technology. These blocks are available in two sizes and in two degrees of translucency: MO for hybrid abutments and LT for hybrid abutment crowns.

Manufacturing the hybrid abutment

To design the abutment with the software program, a digital data set of the oral situation must be generated. For this purpose, the emergence profile was coated with powder and then scanned with an intraoral scanner (Bluecam,

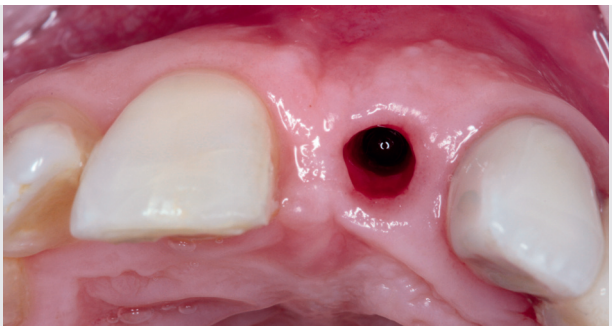


Fig. 5 Circular emergence profile after removal of the healing abutment

Fig. 6 Situation after re-contouring into a more natural, oval-shaped emergence profile with a temporary implant crown in place

Fig. 7 Capturing digital data of the emergence profile using an intraoral scanning device

Fig. 8 Titanium base and scan body – ready for intraoral "impression-taking"

Sirona) (Fig. 7). A matching titanium base was attached to the implant and then a scan body was fitted over the titanium base (Fig. 8). The titanium base features a groove to facilitate referencing. Later on, this groove would again prove useful when cementing the titanium base to the ceramic structure. The scan body and the surrounding soft tissue were coated with powder. Then the soft tissue was digitally captured in a first step, followed by the scan body. This sequence has to be followed due to the rapid contraction of the soft tissue after the provisional crown removal. After "impression-taking" of the antagonist and recording the occlusal relations, we imported the data set into the lab software (inLab, Sirona).

In a few steps, the abutment was digitally formed in a reduced crown shape, taking material-specific parameters into account. The crown margin followed the course of the natural sulcus (Fig. 9). The margin should be placed slightly submucously to achieve a root-shaped emergence profile.

The crown margin should not be positioned too deep in the sulcus and the cementation procedure should remain controllable after inserting the implant crown to avoid cement residues around the implant-retained restoration.

After finishing the design, the lithium disilicate abutment was milled from the IPS e.max CAD block (MO1, A14) that had previously been chosen. Generally, care should be exercised when separating the attachment point to avoid damaging the lithium disilicate ceramic structure.

The crystallized ceramic structure was luted to the titanium base following a standardized protocol. At the first step, the titanium base was conditioned and the surface (bonding surface) was blasted with aluminium oxide (110 µm) at a pressure of 3 bar (43.5 psi). The screw channel was sealed with a small amount of wax to protect it. The bonding area was silanized with Monobond Plus, which was evenly spread over the metal surface. After a reaction time of 60 seconds, any excess material was dispersed with a gentle stream of air. The bonding surface of the ceramic abutments was etched with hydrofluoric acid for 20 seconds (Fig. 10) and then cleaned in an ultrasonic bath for ten minutes. We strictly advise against blasting the ceramic structure. The bonding surface of the ceramic was also silanized with Monobond Plus for 60 seconds. Next, the luting composite (Multilink® Hybrid Abutment) was applied directly from the mixing tip to the bonding surfaces of both the titanium base and ceramic structure and the two parts were joined together (Fig. 11). The above mentioned groove acted again as a reference for the correct positioning of the components. We applied glycerine gel (Liquid Strip) to the cementation joint to prevent the formation of an inhibition layer before the luting composite underwent auto-polymerization. Seven minutes later, the auto-polymerization process of the composite was complete and the glycerine gel was rinsed off with water. Prior to the final placement of the abutment, the basal aspect was given particular attention. The surface – particularly in the submucous region – should encourage soft tissue adherence so that the benefits of CAD/CAM abutments can be optimally realized. It is vital to polish the abutment accurately and clean it before insertion to achieve this (Fig. 12).

Finishing and seating

The temporary implant crown was removed and the hybrid abutment was permanently screwed in to the implant. The soft tissue immediately snugly fitted around the lithium disilicate abutment (Fig. 13). After the screw channel had been sealed, an individually layered lithium disilicate crown (IPS e.max CAD) was inserted, similar to a crown placed on a natural tooth stump. The risk of cement residue in the

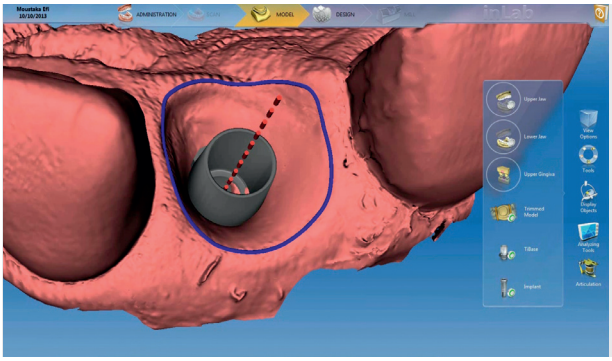
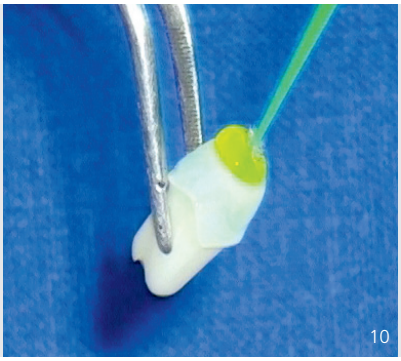
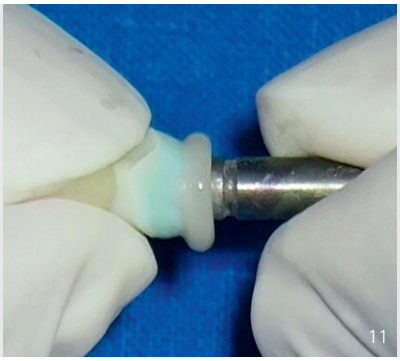


Fig. 9 Defining the crown margins during virtual forming of the abutment





Figs 10 and 11 Hydrofluoric acid is used to create a retentive etching pattern for cementing the lithium disilicate abutment and titanium base. A specially designed auto-polymerizing luting composite creates a reliable bond.

Fig. 12 The lithium disilicate hybrid abutment is ready for seating.

Fig. 13 The lithium disilicate hybrid abutment screwed in to the implant

Fig. 14 The ceramic crown emerges from the gingival line similar to a natural tooth. A harmonious impression is created.

submucous region was successfully circumvented by ensuring that the crown margins were in an ideal location. The result was a restoration that emerged from the alveolar ridge like a natural tooth (Fig. 14).

Conclusion

Until recently, using a screw to retain abutments on implants has been afflicted by a drawback: dental esthetics may have been adversely affected by a screw channel located on the occlusal side or on the labial side, if an unfavourable implant axis is present. This balancing act can be avoided if a lithium disilicate hybrid abutment (IPS e.max CAD Abutment Solutions) is utilized. The CAD/CAM-assisted manufacture ensures a rational procedure (efficiency) and high accuracy. As the connection geometry to the titanium base is premanufactured, only the external geometry is machined in the CAD/CAM unit (precision). The adhesive cementation procedure between lithium disilicate and titanium is straightforward, because a retentive etching pattern can be achieved in a jiffy by using hydrofluoric acid (reliability). The chemically curing composite (Multilink Hybrid Abutment) is especially optimized for this indication and, given its high opacity, is capable of completely masking the grey bonding surface of the titanium base (esthetics). In addition to an efficient manufacturing procedure, high precision and reliable bonding process (titanium and ceramic), the esthetic result presents an essential advantage for this type of implant-supported prosthetic restoration.

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What happens after pressing?

Characterization of a monolithic restoration with the IPS e.max system

Oliver Brix, Bad Homburg/Germany

Monolithic restorations made of lithium disilicate are characterized by high flexural strength, precision fit and optimum function. Lithium disilicate is a very popular material, since it is "antagonist-friendly" and easy to use.

Monolithic lithium disilicate (IPS e.max®) restorations have become an established component of routine dental laboratory work. They offer the following benefits:

- precision replication of a wax model in ceramic
- possibility of creating a biomechanical occlusal surface with the wax-up technique
- no risk of chipping
- recreation of anatomical details even if space is limited
- efficient fabrication.

In the fabrication of monolithic restorations, dental technicians benefit from having the possibility of optimally recreating the individual tooth shape and the functional parameters with the wax-up technique. The waxed-up model is subsequently rendered in ceramic by using the hot-press technique or in a CAD/CAM-based process. In both methods, a copy is made of the waxed-up restoration. Nevertheless, I believe that the press method offers the more precise route. In this article, this procedure is described on the basis of an upper posterior crown.

The wide range of IPS e.max Press ingots allows the brightness and opacity of the restoration to be chosen carefully. In our laboratory, we tend to use ingots that demonstrate a relatively high level of brightness. These ingots include Impulse V 1-3 ingots and HT ingots in shade BL3, B1 and A1.

Figs 1 and 2
Faithful copy of the original tooth in wax


1


2

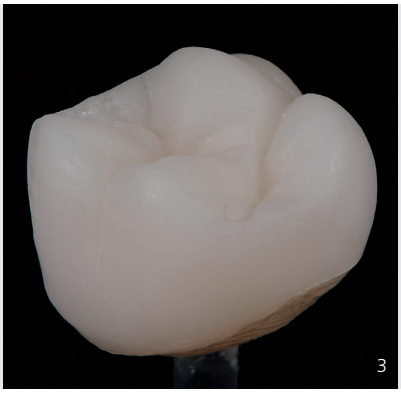

Fig. 3
Reproduction of the wax model with lithium disilicate (HT ingot, shade BL3)

Fig. 4
Determination of the basic shade with IPS e.max Ceram Shades

Figs 5 and 6
Result after the second stains firing cycle

The surface staining of the restorations after they have been hot-pressed allows the chroma and basic colour of the natural teeth to be imitated with IPS e.max Ceram Shades and IPS e.max Ceram Essence materials. Final glaze firing with fluorescent glazing paste (IPS e.max Ceram Glaze FLUO) produces a homogeneous surface and individualized gloss.

Hot-pressing of the restoration

All the functional and anatomical details of the restoration were waxed-up according to morphological criteria using a special wax for the hot-press technique (ProArt®) (Figs 1 and 2). The sprues were placed and the wax-up was invested. Then the selected ingot was pressed into the mould. The restoration was divested and the sprues were cut according to the instructions of the manufacturer. In ideal cases, only minimal adjustments, if any, need to be made on the pressed restorations (Fig. 3).

A precision wax-up is requisite for the detailed reproduction of tooth structures in ceramics.

Individualized surface staining

In order to adjust the shade of the crown, the use of a tooth-coloured acrylic resin die is recommended. The die is fabricated on the basis of the shade of the natural, prepared tooth. For this purpose, the inner surface of the crown is isolated with petroleum jelly and then the acrylic resin is applied with a brush. A plastic stick is useful for holding the restoration. Glycerine gel can be used to prevent the crown from detaching from the die. In addition, this type of gel provides a shade transition between the die and the crown.

In a first step, the body of the tooth and the chewing surface were characterized with IPS e.max Shades that had been modified with Essence materials. It is advisable to apply the stains when the crown is dry to prevent the materials from running. Next, fine colour nuances were applied to the cusps with IPS e.max Ceram Shade I-2 and the marginal ridges with IPS e.max Ceram Essence creme (Fig. 4). The characterized restoration was then fired. Subsequently, the basic colour and chroma were checked and intensified as required.

A second firing is necessary to ensure the precise placement of the stains. The fossa was accentuated with Essence copper and the deepest point was highlighted with Essence mahogany (Figs 5 and 6).

Once all the colour details had been placed, the restoration was ready for glaze firing. For this purpose the FLUO glazing material was applied from a syringe and spread onto the dry chewing surface (Fig. 7). It is not advisable to use a very liquid consistency in occlusal areas, since fissures

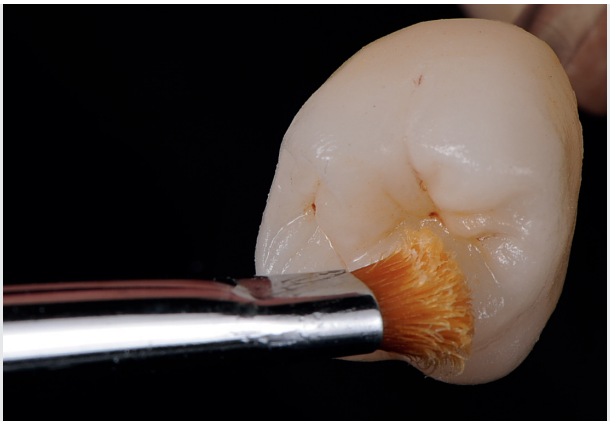

Fig. 7 The FLUO glazing material is spread onto the dry chewing surface.

Fig. 8 The sides of the crown are coated with a liquid glaze.

Figs 9 and 10 The crown coated with glaze before firing

Fig. 11 The crown after glaze firing

and important details may be lost. However, the glazing material for the sides of the crown should be relatively fluid and applied with a fine brush (Fig. 8). The coating should be very thin and even (Figs 9 and 10). Then the restoration was glaze fired with a two-minute holding time and long-term cooling to 450 °C (Fig. 11). Generally speaking, long-term cooling is recommended to prevent any build-up of tension.

After glaze firing, any irregularities were removed with a rubber wheel and the restoration was polished with diamond polishing paste (Fig. 12). When monolithic crowns are fabricated in conjunction with layered crowns – mainly in the anterior region – the labial transition is characterized or adjusted with a thin layer of dentin and incisal material. Additionally, a morphological texture can be incorporated into the surface. These parts, however, should not be glazed. They should simply be fired according to "atmospheric" techniques.

Figures 13 to 15 show monolithic restorations for an entire quadrant. The restorations were fabricated following the same procedure as the one described above.

Fig. 12 Polishing with a diamond polishing paste produces the desired even gloss.

Conclusion

The monolithic approach with lithium disilicate allows the waxed-up posterior restoration to be reproduced in ceramic most efficiently. The risk of chipping is eliminated. Furthermore, fine anatomical details can be recreated even if space is limited. The different ingots and individual staining materials ensure customized, esthetic results.

Figs 13 to 15 This restored dental quadrant featuring monolithic restorations represents a symbiosis of form and function with excellent mechanical and esthetic properties (clinical work: Prof. Dr Daniel Edelhoff).

Acknowledgements

This article describes the laboratory steps involved in the fabrication of a hot-pressed monolithic posterior restoration. In conclusion, I would like to highlight the importance of the smooth collaboration between the dental technician and the attending dentist, without which, work of the kind described in this article would not be possible. In this case, I would like to thank Prof. Dr Daniel Edelhoff (LMU Munich).

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