Replacing a single missing tooth with a bridge in the 12 region

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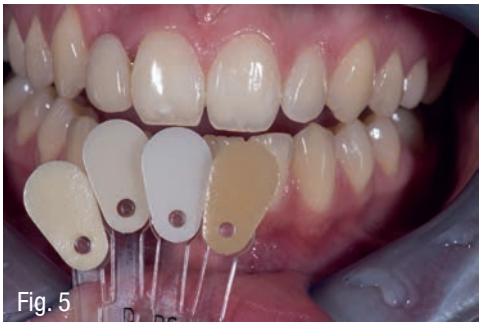
A tooth is a tooth. This statement is correct on the one hand, but it does not do justice to the need or task that a prosthetic team has to deal with when it has to replace a missing tooth. And this applies in particular when it comes to reconstructing an incisor, for which it is necessary to take into account biological conditions, desires and also of the age of the patient. The team of authors describes in this article, the rehabilitation of a 21-year-old patient with a single-wing Maryland bridge in 12 Region. Explained below is how they proceeded, and what they had to take into account.

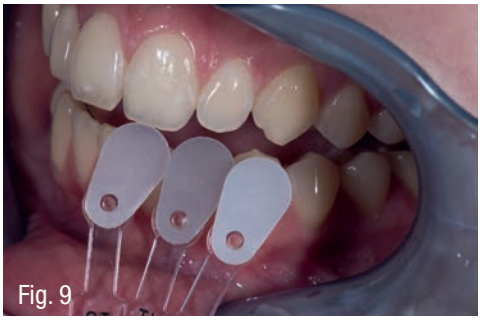
The patient, who at the beginning of treatment, was 21 years old, presented the failure of the tooth 12. The missing single tooth had been restored in the past with a single-wing Maryland Bridge, which had been affixed on the palatal side of tooth 11. However, there was a large vertical and horizontal defect. The difficulty was in conditioning the tissue in order to achieve the effect of the provisional which had come out of the gum, according to the natural model.

The underlying fabric itself was simply lowered. Therefore, the dentist had to first execute a connective tissue transplant around region 12. With the old Maryland bridge you had to now again realize the intermediate element in connection with, and as part of the healing phase.

Fig. 1 — Since the shape of the old prosthesis was somewhat oversized, the intermediate element in region 12 appeared too dominant. The defect in the transition zone with the gum contributes to general disharmony.

Figs. 2 & 3 — To establish the color of the teeth we combined the classical documentation with that of the eLABor_aid protocol. The basic color of the tooth was therefore determined using the color scale of the teeth.





Figs. 4 to 9 — ... on the basis of the basic color of the tooth obtained, with the help of the color samples of the ceramic manufacturer, the ceramic masses for aesthetic masking have been chosen and photographically documented.

Also, the extension part of the old Maryland Bridge in the area of the support surface had to be subsequently layered with composite and then we had to try to insert the intermediate element in the new mucous tissue. After three months the provisional was removed for the first time.

Purpose of the treatment

The goal of the new prosthesis was to improve the transition from pink to white aesthetics and to improve the color and shape of the tooth. The shape of the tooth of the old prosthesis was a bit oversized, in particular in the area of the convexity, and therefore had a too dominant effect (Fig. 1). The intermediate element seemed to be suspended above the mucous membrane. To solve this problem, it was necessary to increase the volume of the gum. Our goal was to conform the intermediate element and the gum in such a way that the intermediate element seemed to emerge from the gum. Due to the age of the patient, the possibility of implant-prosthetic rehabilitation had not been considered.

Color grip

The color of the tooth is a combination of traditional methods and eLABor_aid protocol. This means that the base color of the tooth in question has been determined by color scale (Figs. 2 and 3) and on the basis of this information, with the help of color swatches of the manufacturer of the ceramics, the corresponding masses have been chosen and have been photographically documented in combination with teeth (Figs. 4 to 9).

To check the color of the tooth and to have greater security about the base color of the tooth, that is, the color of the dentin, a polarizing filter with the corresponding adjustments of the camera and flash, according to the eLABor_aid Protocol was also documented the [1]. In this regard it is

Fig. 10 — To verify the color chosen for the tooth and to establish the color of the dentin, photographs were taken with a polarizing filter and with the corresponding camera and flash adjustments and grey card.

important to initially photograph with a partially overlapping gray card. This serves for correspondence, calibration and matching of the photos of the eLABor_aid protocol in Lightroom software (Fig. 10). All other photographs match essentially to those of the classical color (Fig. from 11 to 13).

Initiation of treatment and provisional phase

Figure 14 still shows a clear vault of the crown of the Maryland bridge that is clearly overextended. It is also ivory in color and appears off. In addition to that, the Maryland Bridge also had a defect in the transition with the gum. During the surgical session Dr. Paul Schuh removed the Maryland Bridge and reconstructed the intermediate element with a graft of connective tissue, which was taken from the maxillary tuberosity region of the patient by means of a microsurgical technique. This graft was given the form of a partial thickness flap, which has been applied in the intermediate area (Fig. 15). From the surgical point of view you should pay attention to the intermediate element zone, so that there is still a gain of sufficient substance after the cauterization. The microsurgery was closed with a monofilament suture 6/0 15 to completely cover the graft. The next provisional is started cautiously with conditioning of the intermediate element zone. This means that at this point the attention was focused again on the closure of the empty space and not on conditioning the gum and operative


Fig. 11


Fig. 12


Fig. 13

Figs. 11 to 13 — The gray cardboard is used for the correspondence, calibration and matching of the photos of the eLABor_aid protocol using lightroom software. All the other photographs correspond essentially to those of the classic color group.

Fig. 14 — The crown of the Maryland bridge is clearly overextented and the tooth is too ivory-colored and appears dull. It also has a defect in the transition with the gum

Fig. 15 — In a surgical session the Maryland bridge was removed and the intermediate element area was reconstructed with a connective tissue graft taken from the region of the patient's maxillary tuberosity. With a microsurgical technique, this graft was given the shape of a partial thickness flap, which was applied in the middle element area

Fig. 16 — In the context of the subsequent provisional, a prudent start was made with the conditioning of the intermediate element zone. The attention was still focused first of all on the closure of the empty space and not on the conditioning of the gum and the operating field, which had to be healed first of all

Figs. 17 to 19 — After about three months of provisional in situ, there was already an excellent basis for further conditioning of the intermediate element, and there was a sufficient vertical and horizontal volume

field, which was before all healed (Fig. 16). After about three months in situ, an excellent basis for further conditioning of the intermediate element was already present (Fig. 17). The vertical and horizontal soft tissue volume was sufficient (Fig. 18 and 19) to further shape, a natural tooth emergence profile.

The provisional was therefore intentionally layered with composite in the basal area to further optimize the contour of the tissue (Figs. 20 and 21). The old Maryland ceramic provisional bridge conditioned the gum in the area of the intermediate element and was adequately "rebased" and modeled. The modified Maryland Bridge performed the task of a therapeutic provisional, which served to condition and support the soft tissue.

Definitive prosthesis

After the therapeutic temporary was in situ for a month and a half, we moved on to the realization of the new prosthesis. The provisional was removed and a new preliminary impression was taken. According to the plaster model, it was clear that the intermediate element of the provisional had already adapted well to the tissue and created a good condition for the definitive prosthesis (Fig.22 and 23).

In the next step the model in the intermediate element zone was modified in accordance with the future emergence tooth profile (intermediate element) (Figs. 24 to 24 26). Care must be taken to leave a kind of edge in the vestibular area, so as to ensure that there remains of the tissue against which the intermediate element can exert pressure. The material for the new Maryland Bridge will be ziroxide, second generation (Fig. 27). Figures 28 and 29 show that the material has good transparency. The Maryland Bridge was built with a single wing, i.e. the part to be fixed has been laid in the palatal area of tooth 11. Several authors attribute the prognosis of single-wing Maryland bridges to be better than the two-winged ones [2, 3, 4]. According to the fastening protocol of Stawarcyk and Coll. [5], the single-wing Maryland bridge had to be attached adhesively. For the best possible reproduction of the color and for an additional warranty, a photograph was taken of the zirconium oxide bridge on the model, in accordance with the Protocol eLABor_aid (Fig. 30). The cardboard gray that is photographed with it serves as chromatic and spatial orientation and also for the calibration of the processing program of the imagery. With the help of this photograph, you can try it virtually in situ the result of stratification [6, 7].

To take into account the age and therefore the social behavior of the patient, it was necessary to lend particular attention to the theme of the effect of color in conditions of different light. In particular, under ultraviolet light, materials are not fluorescent and therefore the artificial or prostheses crowns in general are unmasked [8, 9].

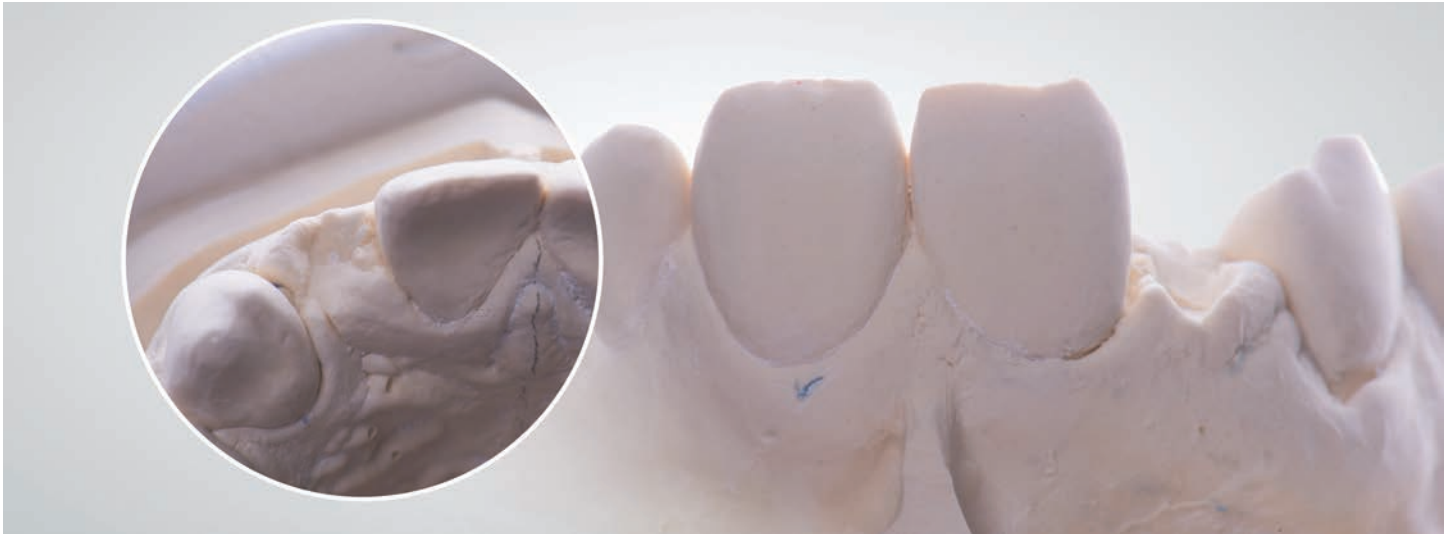
Fluorescence

Zirconium oxide does not fluoresce. (Fig. 31). For this


Fig. 20


Fig. 21

Figs. 20 & 21 — For the handling of soft tissue, the temporary was intentionally stratified with composite in the basal area. Moreover, in the provisional the old Maryland ceramic bridge, was "rebased" and shaped.



Figs. 22 & 23 — After the therapeutic temporary remained in situ for a month and a half, the definitive realization of the new prosthesis began. The provisional was removed and a new preliminary footprint was noted. On the plaster model it was seen that the intermediate element of the provisional had already been able to adapt well

reason, the material must be equipped later with fluorescent characteristics. For experimental purposes, a very fine ground ceramic powder was made available to the authors, which is actually thought of as a mass of fluorescent glasura. To prevent them from going with a final glasura losing all the surface details prepared or modifying the chromatic effect, it is proposed to apply the mass as in the case of a cooking wash on the surface of zirconium oxide Master dental technician Bastian Wagner preferred the method in which the core is wetted with kneading liquid and then the powder is distributed with a brush. (Fig. 34). Then cooking followed at 780 °C (under vacuum starting from 450 °C, no holding time), with which the fluorescent powder has been fixed on the zirconium oxide.

The zirconium oxide treated in this way emits a fluorescence (Fig. 35), which corresponds to the natural pattern. The difference between "zirconium oxide treated and untreated" becomes particularly evident in figure 36. Here we see that the untreated wing of the Maryland Bridge is barely recognized under UV light, while instead the treated intermediate element presents a beautiful fluorescence. The restoration will have the same effect in the patient's mouth if it appears in an atmosphere of ultraviolet light.

Digital Beam test

The beam treated with fluorescence was then digitally tested. It is worth noting that at this point, the eLABor_aid protocol has materialized.

For this purpose, a photograph of the model is compared with the gray card (Fig. 37) and with the aid of a processing program of the images, is inserted in the corresponding photograph of the mouth (Fig. 38). The gray card serves for color matching and for calibration. This step helps to verify the chromatic effect of the beam. It is especially necessary to ascertain the value of brightness and the chromatic value.

In the next step, a customized dentin is mixed on the basis of the analysis of eLABor_aid (Fig. 39). This corresponds to the basic chromatic hue of the dentin of the patient.

Finish

After ascertaining all the information

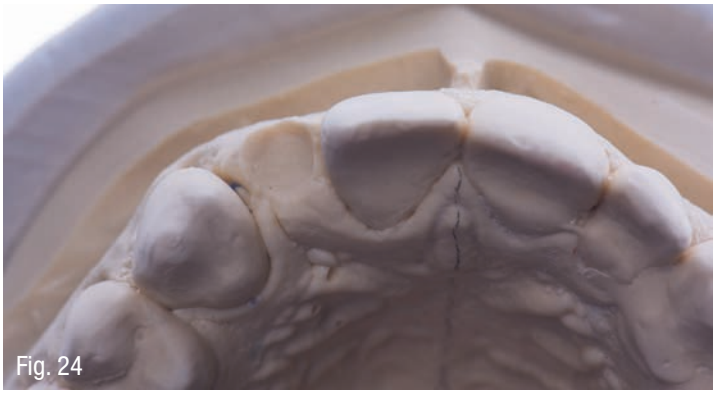


Fig. 24

related to color, it was possible to switch to aesthetic masking of the intermediate element. For this knowledge has been used and dental skills, finally fabricating a crown to offer to the patient.

The crown was also tried to control the color effect virtually and with the help eLABor_aid protocol (Fig.40 and 41). The photographs taken with the transverse polarizer filter guarantee the elimination of annoying flexing. So the color of the prosthetic tooth corresponds to that of natural models.


Fig. 25


Fig. 26

Figs. 24 to 26 — In the next step, the model of the intermediate element was modified to correspond to the emergence profile of the pontic. An edge is needed in the vestibular area to ensure that some tissue can exert pressure against the intermediate element.


Fig. 27


Fig. 28


Fig. 29

Figs. 27 to 29 — The new Maryland single-wing bridge was employed using a second-generation zirconium oxide. The material is distinguished by a beautiful transparency and, thanks to its solidity

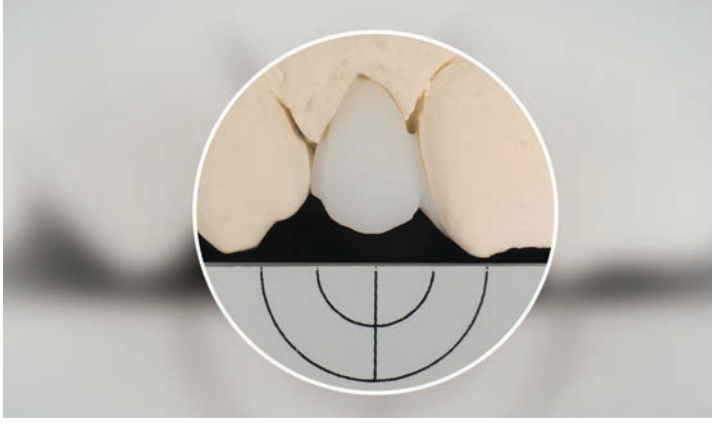


Fig. 30 — For the best possible reproduction of the color and for an additional guarantee, under the eLABor-aid protocol a photograph of the zirconium oxide was taken on the model. With the help of this photograph you can virtually prove the result of layering in situ

Fig. 31 — Since zirconium oxide does not itself fluoresce, the material must be equipped with fluorescent features

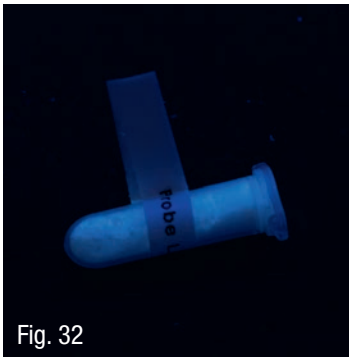


Fig. 32

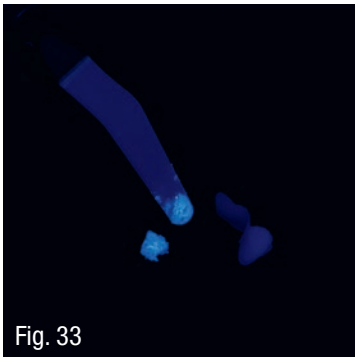


Fig. 33

Figs. 32 to 33 — For experimental purposes, a very fine ground ceramic powder was made available to the authors, which is actually thought of as a mass of fluorescent glasura. To prevent them from going with a final glasura losing all the surface details prepared or modifying the chromatic effect, it is proposed to apply the mass as in the case of a cooking wash on the surface of zirconium oxide

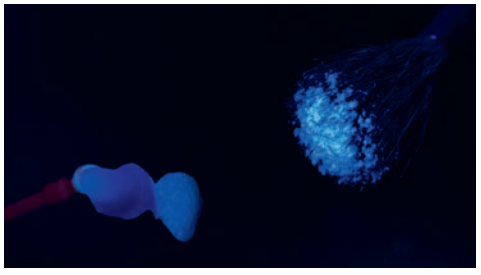


Fig. 34 — The zirconium oxide core is wetted with kneading liquid and fluorescent ceramic powder is added with a brush, after which firing is carried out at 780 °C (under vacuum from 450 °C, no holding time)

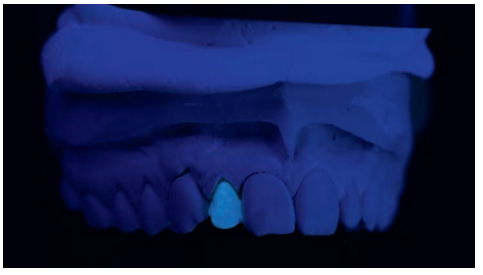


Fig. 35 — The zirconium oxide thus treated is now fluorescent and can no longer be recognized as a prosthesis under UV light

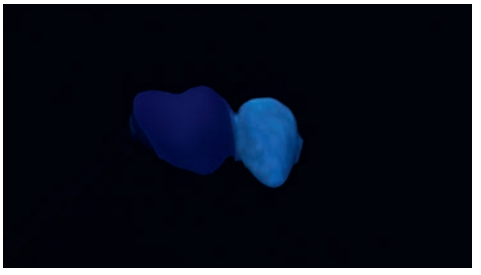


Fig. 36 — The difference between "treated and untreated zirconium oxide" becomes particularly noticeable when observing this figure. The untreated wing of the Maryland Bridge is almost not recognizable under UV light, while instead the treated intermediate element is fluorescent

Fig. 37

Fig. 38

Figs. 37 & 38 — Zirconium oxide devata has been digitally tested in accordance with Protocol eLABor_aid. Gray cardboard works with an image processing program of the model and the corresponding photograph of the mouth

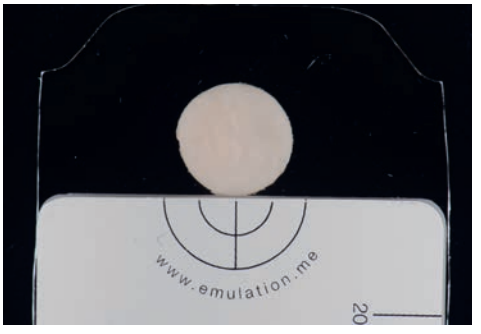


Fig. 39 — Based on the analysis of the L*a*b* values by eLABor_aid, individual dentin was mixed

Fig. 40

Fig. 41

Figs. 40 & 41 — After the aesthetic masking of the zirconium oxide beam, a virtual test was undertaken in accordance with the protocol eLABor_aid for a new control of the chromatic effect. The photographs taken with the transverse polarizer filter ensure the elimination of annoying reflections. So you can check if the color of the obtained tooth corresponds to that of the natural model

Fig. 42 — After the removal of the provisional it was seen that the gum with the intermediate element was able to be reshaped

Fig. 43 — The intermediate element not yet brought to the final mirror polishing was tried in the mouth and the chromatic effect and shape were checked

Figs. 44 & 45 — These images, which show the situation before the insertion and final fixing of the Maryland bridge, clarify once again the good gum condition that was possible to achieve thanks to soft tissue operation and tissue conditioning (five months after the start of treatment)

Figs. 46 to 49 — The situation immediately after the final fixing: the overall picture is harmonious. The mesial papilla could bear a little more volume; however the space has been created for this to happen


Fig. 50


Fig. 51

Figs. 50 & 51 — Ten months after the start of treatment it is evident that the tissues are stable and there has been no resorption of the mesial papilla, which has even grown a little more. The missing tooth of the patient could therefore be replaced very well with a single wing Maryland bridge and without resorting to a implant prosthetic restoration

Appointment for the try-in in mouth and cementation

On the day of the try-in in the mouth after removal of the provisional so that the gum with the intermediate element could be reshaped even better (Fig. 42). The intermediate element not yet brought to final mirror polishing was tried in the mouth (Fig. 43) and checked with regards to the chromatic effect and the shape.

After minimal corrections the Maryland bridge could be finished and attached adhesively. That is why we stick to the Protocol of Stawarcyk and Coll. [5], i.e. cleaning and stiffening (creation of a retention) and activation (both operations possible by sandblasting with corundum) of surfaces from adhesive cement, conditioning of zirconium oxide surface with monomers based on phosphoric acid and adhesive cementation with an appropriate composite.

The Maryland Bridge could be affixed in a non-invasive way, because there was enough space and the patient did not have any contact in the palatal area of the incisors. So the tooth adhesion surface had to be only roughened with Al2O3 (1 bar, 40 µm) and subsequently cleaned. The images taken before insertion and cementing the final Maryland bridge verify once again the good gum conditions that were possible to obtain thanks to the soft tissue surgery and conditioning of the tissue (Figs.44 and 45). There are just five months between these photographs and the beginning of treatment.

Immediately after the final fixing the general picture is harmonious (Fig. from 46 to 49). Only the mesial papilla could have gained a bit of volume. However, space was created because this happened. Now it's up to nature take advantage of this "possibility".

Final image and conclusion

Ten months after the start of treatment you can talk about a very successful result (Figs. 50 and 51). The tissues are stable, there has not been any resorption of the mesial papilla, which instead has even grown a little more. Offering the patient a single-wing Maryland Bridge replacement for a single tooth in region 12, compares to an implant-prosthetic restoration:

a) ... is less invasive...
b) ... is more durable...
c) ... is aesthetically easier to treat (pink-white aesthetics) ...
d) ... is even cheaper

Using a zirconium oxide mass equipped with the necessary fluorescence is a clever concept to replace the missing tooth of a young patient in a suitable inconspicuous and durable way. SD

About the Authors

Dr. Paul Leonhard Schuh after training as a dental technician in Bamberg, began to study dentistry and maxillofacial surgery, which he completed in 2012. He then worked as a research assistant in the Department of Dental Prosthesis and Dental Technology at the Private University of Witten/Herdecke, under Prof. Dr. Andree Piwowarczyk. During his studies he founded the DSGI curriculum, together with Karl Bühring, awarded by the University Witten/Herdecke in 2008 as winner of the "Gründerwerkstatt". He showed his commitment to dental students and young assistants working as a member of the Council of the BdZM (Federal Association of Dental Students in Germany) and also of the BdZA (Federal Association of Alumni of Dentistry in Germany).
In addition to his first publications and his first interventions at national level, his anterior aesthetic reconstruction work was awarded with the 2nd place at the Global Ceram-X Case Contest in 2012/2013. He completed the postgraduate program to specialize in periodontology at Bolz/Wachtel in Munich and is a member of the editorial board of online dental college.

Odt. Master Bastian Wagner began his training as a dental technician in 2001. He specialized in the fields of aesthetics and function of integral ceramics and implant prostheses. From 2010 to 2011 he attended master's school in Munich. In 2011, he took over the management of the laboratory of Dr. Markus Regensburger in Munich, Bavaria. During this period he completed master classes in Germany and abroad on the themes of aesthetics, function, phonetics and implant prosthesis. Since 2015 he also worked as a consultant for several dental companies. Today he works at the Dental Implaneo Clinic in Munich for renowned dentists such as Dr. Wolfgang Bolz, Prof. Dr. Hannes Wachtel and Dr. Paul Schuh.