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# Micro-layering – new developments of an old technique

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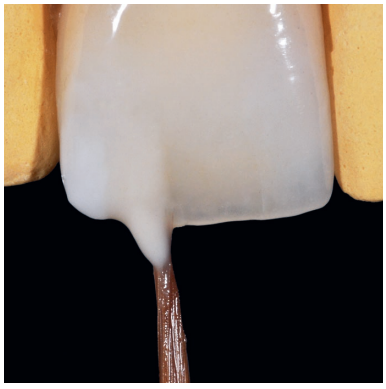


QUINTESSENCE PUBLISHING

FIELD REPORT

# Micro-layering - new developments of an old technique

Working with the Dentaurum 2-D and 3-D pastes

WERNER GOTSCH

## Introduction

At the time the author made his first attempts at ceramics many years ago, he was fortunate that the dentist Dr. Eicke Schmalfuß was practicing just a few houses away.

The dentist, who worked in Marktleuthen in the Fichtel Mountains, taught the dental technician how to support patients during their treatment. One only has to ask the right questions, to get the right answers. It is all about recognizing people's wishes and, wherever possible, fulfilling them.

The follow-up discussions about the incorporated work were often held in the evening, after the work had been done in the office. Quite often, the author's gaze fell on a display case containing anatomical exhibits and old dental instruments, as well as a small white palette of the kind one would normally only find in an artist's studio. Only much smaller and made of porcelain.

Upon questioning by the author, it turned out that this belonged to a paint box, a small wooden box that was still completely intact, including the working instructions (Figs. 1 and 2). A small cardboard box with ceramic teeth, the blanks, rounded off the collection (Fig. 3).

At the handover of the practice, Dr. Schmalfuß gave the author this dental rarity with the words to take good care of it and to treasure it in his spirit. Said and done. This is how a product came into possession of the author which is more topical than ever these days: perhaps the world's first set of ceramic stains. In the instructions, which are probably about 100 years old, the following was written (Fig. 4): „The enamel stains are not intended to be used to recolor stocked artificial teeth in every case, or to paint, as this would require far too much practice

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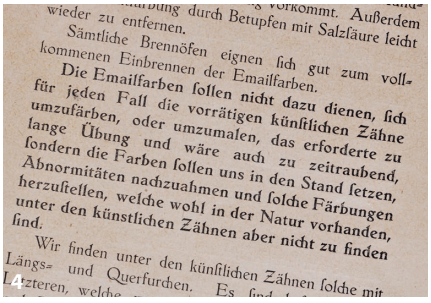

wieder zu entfernen.
Sämtliche Brennöfen eignen sich gut zum voll-
kommenen Einbrennen der Emaillarben.
Die Emaillarben sollen nicht dazu dienen, sich
für jeden Fall die vorrätigen künstlichen Zähne
umzufärben, oder umzumalen, das erforderte zu
lange Übung und wäre auch zu zeitraubend,
sondern die Farben sollen uns in den Stand setzen,
Abnormitäten nachzuahmen und solche Färbungen
herzustellen, welche wohl in der Natur vorhanden,
unter den künstlichen Zähnen aber nicht zu finden
sind.
Wir finden unter den künstlichen Zähnen solche mit
Längs- und Querfurchen.
4

**Summary**
All-ceramic dental restorations can be realized in different ways. Based on a number of cases, this paper describes veneering techniques on zirconium oxide with products from the Dentaurum company (Ispringen).

**Keywords**
Micro-layering, zirconium oxide, veneering technique, press ceramic, 3-D pastes

**Fig. 1 to 3** This approximately 100-year-old paint box system for dental ceramics stems from the author's collection. Added is a compartment with ceramic teeth, the blanks. **Fig. 4** The instructions for what was probably the world's first set of ceramic stains state, among other things: „The enamel stains (...) are intended to enable us to imitate abnormalities and to produce such colorations as can be found in nature but cannot be found among artificial teeth."

and would also be too time-consuming, but the stains are intended to enable us to imitate abnormalities and to produce such colorations, which are indeed present in nature, but are not to be found in artificial teeth."

So the basic idea was already the same almost 100 years ago as it is today: one strived to copy nature, albeit with modest means.

For many years, metal ceramics processed on alloys with a high gold content were the gold standard before the so-called economy or non-precious metal alloys became established as a result of enormous cost pressure in the healthcare sector.

The first all-ceramic systems also entered the market at the same time. The photo-optical properties, transparency and light transmission of these systems inspired the industry right from the very first moment. However, they were not suitable for bridge structures due to their low strength. Many more years passed before a new material which also offered sufficient strength for bridges became a talking point.

The success story of zirconium oxide ceramics had begun and is still far from ending.

## The triumph of zirconium oxide

The use of materials such as zirconium oxide in restorative prosthetic dentistry was only made possible through new processing technologies and continuous further development. For comparison purposes, Figure 5 depicts a first-generation zirconium oxide framework on the left and a framework made of ceraMotion Z Hybrid (Dentaurum, Ispringen) on the right, a multilayer zirconium oxide of the latest generation with different strengths (1020 to 1300 MPa). The translucency of ceraMotion Z Hybrid varies between 44 and 47 percent in five layers. There are 20 years of development time between the two frameworks. Particularly impressive: the light conductivity of the latest zircon generation.

Gone are the days when considerable space was lost due to completely opaque metals or very opaque all-ceramic framework structures. Space that was or would have been urgently needed for a natural color structure and an individual crown design. With the new translucent ceramics, which soon became available in all common tooth shades, the temptation to extend the framework structure to the anatomical tooth shape and finalize it with partial or vestibular veneers was inevitable. This would allow realizing maximum stability with variable crown design. This may already have been the beginning of today's much-cited micro-layering.

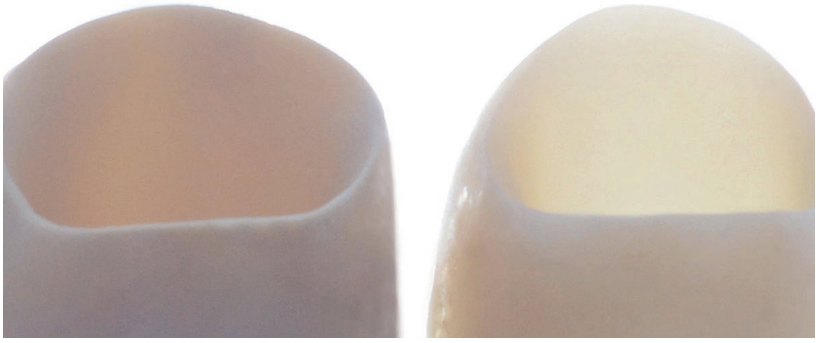


**Fig. 5** For comparison purposes, a first-generation zirconium oxide framework is depicted on the left and a framework made of multi-layered zirconium oxide with an increasing translucency gradient (ceraMotion Z Hybrid, Dentaurum, Ispringen) on the right.

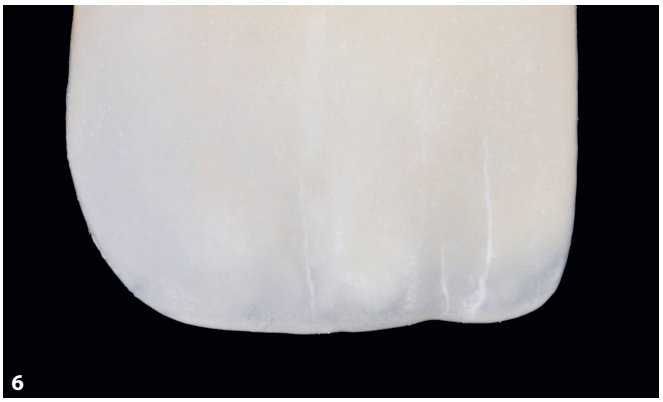
## The beginnings of micro-layering

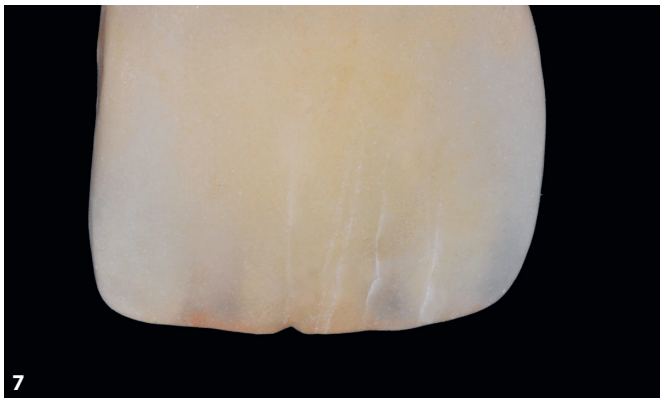
The author made his first attempts with an intermediate layer of painted „individuality" and then completed the anatomical tooth shape with some veneering ceramic. However, the results obtained did not prove satisfactory. Enamel cracks appeared too static, lacking depth (Figs. 6 and 7). The stains used for this purpose turned out to be less suitable for precisely this purpose, as their consistency was both difficult to control and also to process.

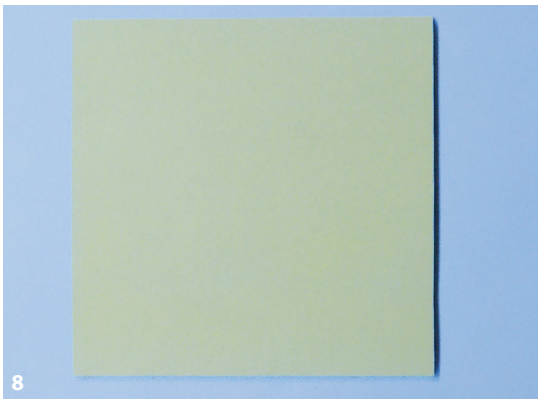
Not far from the author's home, in the Czech Republic, lie the spas of Marienbad, Franzensbad and Karlsbad. When one enters the mundane hotels or villas there, one is faced with magnificent stucco ceilings as well as elaborate decorations on the walls. On closer inspection, however, one realizes that some of these architectural details have „only" been painted on. This gives an impression of reliefs „growing" out of a flat wall, which look amazingly realistic - a contrast of creamy bright wall colors and gray tones. Nothing therefore seems more obvious than to also adopt this contrast painting technique for enamel cracks as well.

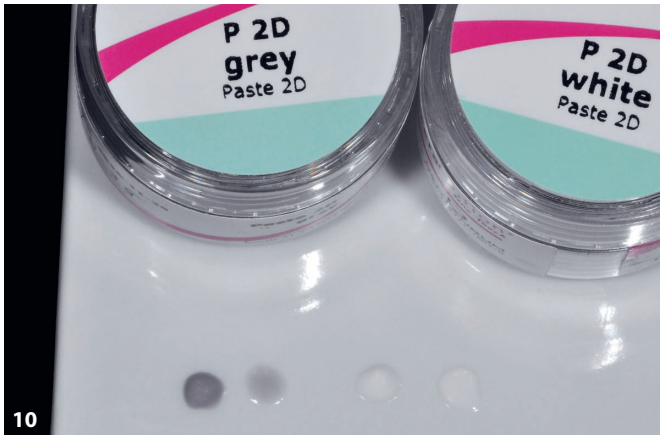
## The principle of contrast

If one places a pad of notepaper on the photocopier, a shadow appears where the pages are not glued, i.e. where they lie loosely on top of each other. This con-









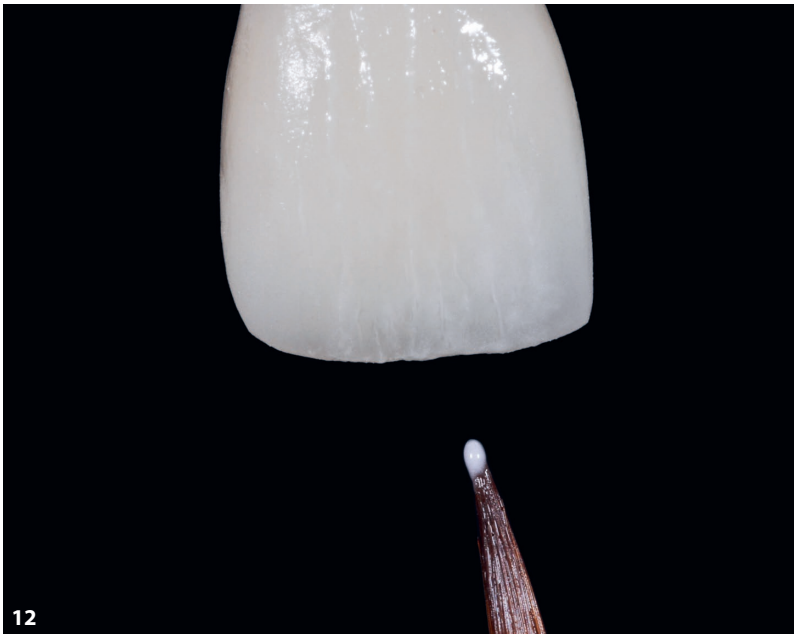

**Figs. 6 and 7** Initial attempts with painted „individuality" in the intermediate layer did not prove satisfactory. The enamel cracks appeared too static, lacking depth. **Fig. 8** The contrast principle: if one places a pad of notepaper on the photocopier and makes a copy, this pad will feature a shadow on one edge of the copy. This contrast causes the block, which is basically flat, to take on a spatial appearance. **Fig. 9** The ceraMotion One Touch System from Dentaurum, Ispringen. **Fig. 10** With the 2D Grey and 2D White pastes it is easy to simulate depth.

trast causes the block, which is basically flat, to take on a spatial appearance - creating a three-dimensional look (Fig. 8).

## The patient cases

The ceraMotion One Touch System from Dentaurum (Fig. 9) is a specially developed 2D and 3D paste for the aesthetic finish and characterization of all-ceramic restorations made of lithium disilicate and zirconium oxide. The author found the consistency of the ready-to-use pastes impressive. For example, with the 2D Grey and 2D White pastes (Fig. 10) it was easily possible to place these reliably and thus simulate „depth". The 3D pastes can be used to make shape and shade corrections at every stage of production. All pastes burn homogeneously and remain stable in terms of shape and shade.

Both of the following patient cases were initially restored temporarily after gingival treatment and finally with all-ceramic crowns after a healing phase of several months.



## *Case 1*

Micro-layering and micro-painting in practice, the initial situation of the first patient case: an anterior all-ceramic restoration that was only a few years old had turned into a handicap. The female patient was not so much dissatisfied with the tooth shade, but more so with the very artificial appearance of the restoration and the exposed crown margins (Fig. 11).

With the aid of micro-painting, enamel cracks, as often seen in natural mandibular anterior teeth, were transferred to the new maxillary restoration, i.e. painted according to the contrast principle (Fig. 12) and then fixed with an intermediate firing. The crown shape was completed with transparent material, and a mixture of enamel and transparent material was used in the incisal area. Figure 13 depicts the finished work, a detailed view is shown in Figure 14.

**Fig. 11** The initial situation of the first patient case: the old anterior all-ceramic restoration was to be replaced. **Fig. 12** Enamel cracks, such as those found in the natural anterior teeth of the lower jaw, were transferred to the new maxillary restoration using the contrast principle with the aid of so-called micro-painting. **Figs. 13 and 14** After intermediate firing, which was used to fixate the enamel cracks, the crown shape was completed with transparent material. A mixture of enamel and transparent material was used in the incisal area.

**Fig. 15** For the second patient case, incisal and vestibular anatomically reduced 360° veneers were to be fabricated from press ceramic. **Figs. 16 and 17** The two incisors were lengthened slightly, canine guidance was redesigned and details of the natural mandibular anterior teeth were transferred to the maxillary restoration.

## *Case 2*

For the second patient case, incisal and vestibular anatomically reduced 360° veneers were fabricated from press ceramic. The initial situation presented with significantly filled and abraded anterior teeth (Fig. 15). The two incisors were lengthened slightly, canine guidance was redesigned and details of the natural mandibular anterior teeth were transferred to the maxillary restoration (Figs. 16 and 17).

## *Case 3*

It quickly became apparent that the advent of transparent high-performance ceramics also made a new manufacturing strategy possible. The use of adequate ceraMotion One Touch components on the pre-stained base material made it possible to achieve individuality in the incisal area, whereas only little retouching was required for the labial surface and in the cervical area to achieve very good results.

To give an example, the molar crown milled from ceraMotion Z HT Multishade depicted in Figure 18, which displays a beautiful shade gradient. During construction, the crown or bridge is positioned in the blank such that, depending on the enamel or dentin content of the restoration to be fabricated, the tooth shade is already supported by the framework material. The initial situation is depicted in Figure 19. After a basic layer with dentin and enamel, 2D and 3D One Touch pastes were applied as an intermediate layer by micro-layering; „creative painting", as the author likes to describe it. This was fixated with an intermediate firing (Fig. 20). The shape of the crown was subsequently completed in a final firing. The incisal margin can be created quite easily by observing two things: use of a photo-optical high-performance ceramic and copying the anatomy of the natural adjacent tooth (Figs. 21 and 22).

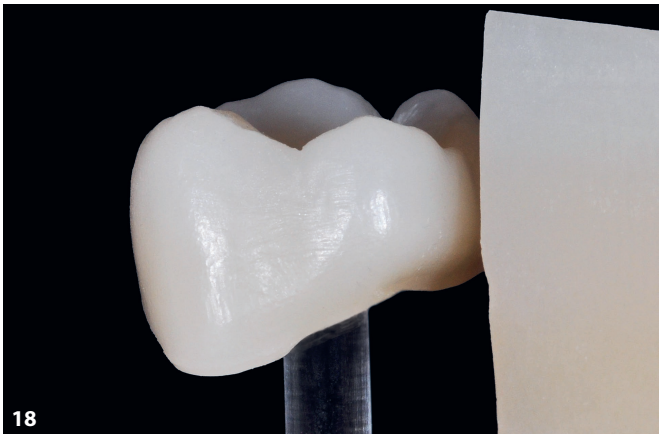


**Fig. 18** A molar crown milled from ceraMotion Z HT Multishade. The material boasts a beautiful shade gradient.
**Fig. 19** Initial situation: tooth 11 was to be reconstructed using all-ceramics.
**Fig. 20** The ceraMotion Z HT Multishade framework was customized with 2D and 3D One Touch pastes in an intermediate layer after basic layering with dentin and enamel material. **Figs. 21 and 22** After fixating these internal characteristics, the crown shape was completed in a final firing.

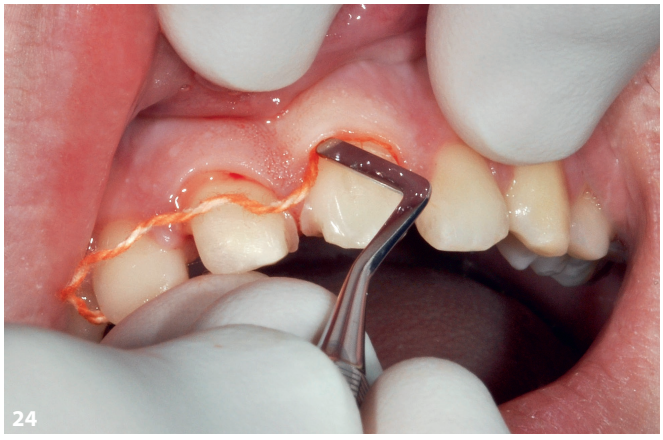
## *Case 4*

In the next patient case, all-ceramic partial crowns were to be fabricated on teeth 11 and 21 (Fig. 23). Normally a classic case for a lithium disilicate solution, and just a year ago the author would never have thought of considering zirconium oxide as a base material for the solution. However, due to the high light conductivity of ceraMotion Z HT Multishade (cf. Fig. 5) as well as the shade deviation of tooth 11, it could be assumed that the somewhat more dense appearing zirconium oxide would form a good base for the restorations. The clinician, Dr. Thomas Greßmann, placed the retraction sutures (Fig. 24). The frameworks made

of ceraMotion Z HT Multishade in shade A1 are depicted palatally on the model in Figure 25. In a first step, the basic shape was created with a dentin incisal base layer. The incisal effect was supported with the Incisal Modifier blue (see Fig. 30). The modifier was shaded yellow for the photo (Fig. 26).

This was followed by discreet micro-layering in the incisal area with One Touch 2D and 3D pastes (Fig. 27), which were fixated with an intermediate firing. The next step was to complete the tooth shape with enamel and transparent materials. In Figure 28, the finished restorations are depicted in situ; the high light conductivity in the cervical region ensures that the boundaries between lithium disilicate and the latest generation of zirconium oxide are blurred.

The quality and benefits of a ceramic system always come to the fore when difficult cases need to be solved. The work presented here is regarded in everyday laboratory life as a so-called stress test or, as a colleague highly esteemed by the author puts it: the ultimate punishment. The author's approach is always the same: determination of the basic shade, frameworks for perfect shade support from the Multishade variants, ideal positioning of the restoration in the CAD software and subsequent milling. Dentin incisal base layering, individualization with 2-D and 3-D pastes, completion of the crown shape with enamel, transparent or effect materials. If necessary, final corrections with 2-D and 3-D pastes during glaze firing.

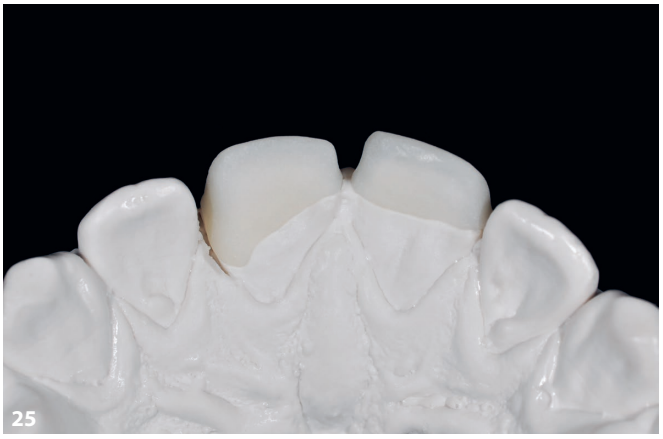





**Fig. 23** For this patient, all-ceramic partial crowns were to be fabricated for teeth 11 and 21. **Fig. 24** The clinician, Dr. Thomas Greßmann, placed the retraction sutures for the impression. **Fig. 25** The frameworks made of ceraMotion Z HT Multishade in shade A1 palatally on the model. **Fig. 26** In a first step, the basic shape was created with a dentin/incisal base layer. The incisal effect was supported with the Incisal Modifier blue (shaded yellow for the photo).

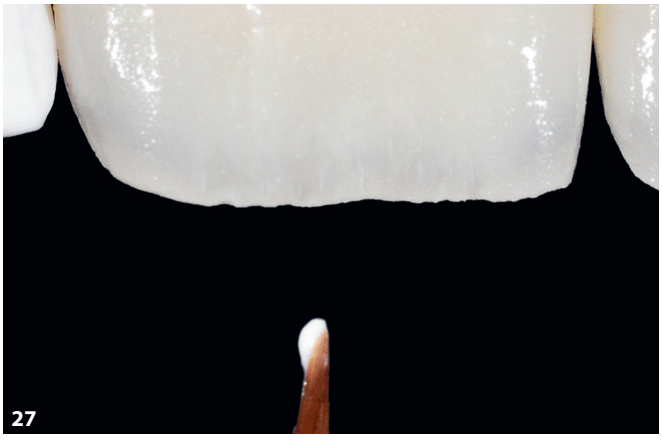


**Fig. 27** Discreet micro-layering in the incisal area with One Touch 2D and 3D pastes. **Fig. 28** The tooth shape was completed with enamel and transparent materials. The finished restorations in situ show high light conductivity in the cervical region - this is where the boundaries between lithium disilicate and the latest generation of zirconium oxide become blurred.

## *Case 5*

The initial situation of the next case is depicted in Figure 29. Tooth 11 was to be restored with an all-ceramic crown. The primary objective was to create a restoration which did not differ from the natural model - tooth 21. ceraMotion Z Cubic Multishade was used for the framework, which was coated with a dentin-enamel base layer. The crown body was customized with Incisal Modifier opal grey, and the enamel materials and the Modifiers opal blue and opal honey (Fig. 30) were used for the incisal area applying the classic layering technique. Figure 31 illustrates that there is also another option. With ceraMotion One Touch and One Touch No Limits, more than 30 2D and 3D variants are available to solve the case differently. Figure 32 depicts the already finished crown on the model. A neutral 3-D incisal paste was used distally and the corresponding 3-D paste honey was used in the central incisal area - a possible solution option for micro-layering. The finished restoration is displayed in Figure 33.

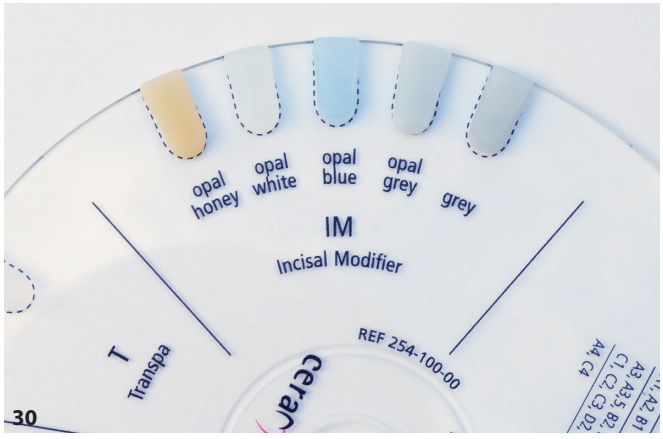



**Fig. 29** Initial situation of the next case: tooth 11 was to be restored with an all-ceramic crown. **Fig. 30** The crown body made of ceraMotion Z Cubic Multishade was customized with Incisal Modifier opal grey, enamel materials and the Modifiers opal blue and opal honey were used for the incisal area applying classic layering.

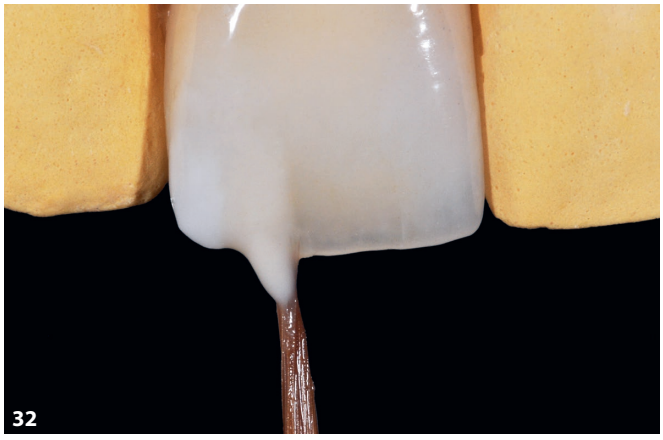





**Fig. 31** With ceraMotion One Touch and One Touch No Limits, more than 30 2D and 3D variants are available. **Fig. 32** The finished crown on the model. A neutral 3-D incisal paste was used distally and the corresponding 3-D paste honey was used in the central incisal area. **Fig. 33** The finished restoration in situ.

## *Case 6*

Finally, here is a typical case that one often encounters in everyday laboratory work: posterior teeth are to be restored with all-ceramic inlays. Teeth 25 to 27 exhibited extensive resin fillings in part (Fig. 34). Basis for the all-ceramic restoration was formed by ceraMotion LiSi press pellets of shade HT 2. For cases like this Dentaurum offers a practical solution: two glaze materials with different brightness fluorescence (Fig. 35). The bright shade is particularly suitable for cusp slopes or for creating transitions to the tooth structure. Finally, the occlusal surfaces are finished with the ceraMotion One Touch 3-D pastes, depicted here using a molar crown as an example. The consistency of the 3-D pastes is very well adjusted (Fig. 36). Examples like these demonstrate: micro-layering is indispensable in daily practice these days. The completed, incorporated all-ceramic inlays for 25, 26 and 27 are depicted in Figure 37.

## Conclusions

As the author's daily laboratory work exclusively involves the fabrication of custom-made products, the materials used are of major importance. Quality and reproducibility are the decisive factors here. Perhaps reliability is the best term that determines success or failure - not least in economic terms. In the cases presented in this paper, the author employs different approaches to the solutions. And yet all the materials used here stem

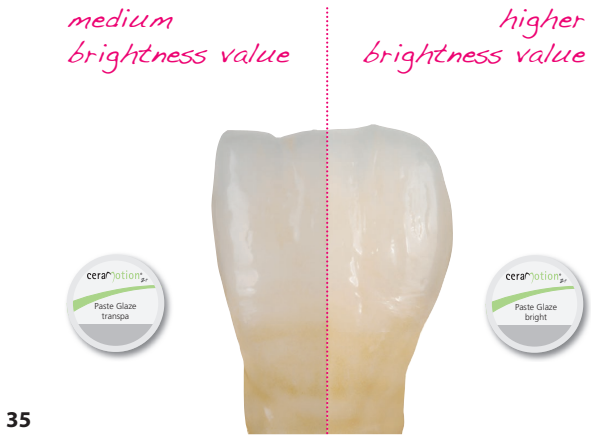






**Fig. 34** The posterior teeth with large composite fillings were to be restored with all-ceramic inlays. The ceraMotion LiSi press pellets of shade HT 2 (Dentaurum) were to form the basis for the all-ceramic restorations. **Fig. 35** Different effects in terms of brightness can be achieved with two different fluorescent glazing materials from the ceraMotion One Touch range. **Fig. 36** The ceraMotion One Touch 3-D pastes are also suitable for finalizing the occlusal surfaces - shown here using a mandibular molar crown as an example. **Fig. 37** The completed, incorporated all-ceramic inlays.

from a single source. In this case, the system concept makes sense, as it is only the manufacturer of a ceramics system who can perfectly match the individual components to each other.

The author is impressed by the rapid further development of zirconium oxide ceramics. The new Multishade variants Hybrid, HT and Cubic in particular offer the perfect basis for reliably solving even difficult patient cases. With the ready-to-use 2-D and 3-D micro-layering pastes, almost 40 additional options are available to provide extra design possibilities for every stage of production. All system components harmonize with each other and serve as the basis for successful and economical work.

## Acknowledgements

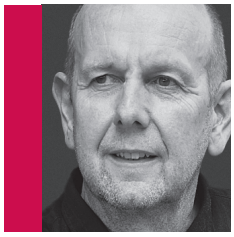
The author wishes to thank Dr. Eicke Schmalfuß for his kind and professional guidance, which he experienced during his first years in the profession and which greatly influenced him. He was often too generous in terms of individuality and his drive had to be curbed somewhat. His comforting words, but also the ability to motivate, ensured that the author has never lost the passion for his profession to this day.

Further thanks go to Dr. Thomas Greßmann, whom the author met in unusual circumstances over 20 years ago. The initial impression on my first visit to the practice remained intact. The equipment, the separate OR, CBCT, everything spread over several floors and the entire practice concept, which was completely new to the author at the time - all of this made a strong impression on the author.

„Every tooth represents a whole person“: this holistic credo of the practice and the immense knowledge of Dr.

Greßmann have inspired the author. In all the years of collaboration, the author and Dr. Greßmann were able to accompany developments for the industry, stand on stage together and much of their joint work travelled the globe. The basis for this were countless hours of work in the practice and in the laboratory.

Shortly before one of the most recent works was incorporated, depicted in Figure 33, the author was content with his world. In response to his statement „I can't do any better", Dr. Greßmann replied: „One can always do better". The author would like to express his sincere thanks for this attitude and for 20 instructive and wonderful years.



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