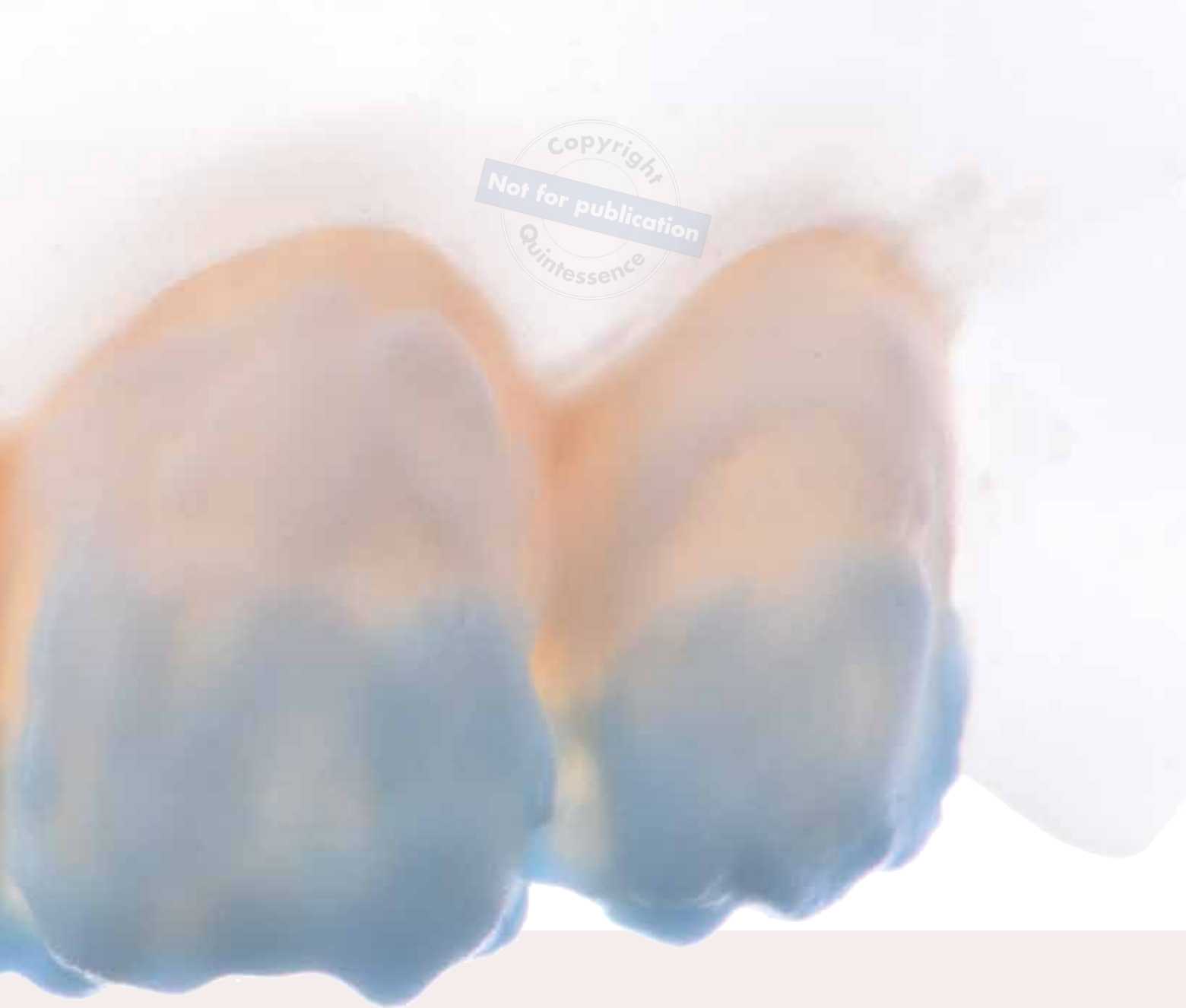




**Contrast
and Filter
Techniques
in Ceramic
Layering
for Natural-
Looking
Anterior
Crowns**

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Modern dental techniques are dominated by digital processes. Materials have gotten better and better, becoming more user friendly and requiring less effort. Modern digital approaches and materials enable us to create more natural-looking crowns and denture frameworks, but even if clinicians take advantage of every kind of modern information technology, including digital photography, digital shade taking, digital shade measurement, oral scans, facial scans, milling techniques, and digital printing, the process must be guided and finished by a dental technician. The difference is merely in the amount of finishing that is required. Is it just some grinding and

polishing and a glaze bake? Or is it a complex procedure that must be performed by a highly skilled and experienced professional?

My laboratory is based in the center of Germany in a quite populous area. It is a medium-sized dental lab with about 40 employees. The main focus is on fabricating all-ceramic crowns and partial dentures. Most cases that are done in this lab are “result” cases, meaning the functional and esthetic results of the restoration are more important than the price. Most people want bright, fresh, and shiny crowns or veneers that look like natural teeth.

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FIG 1 Six Celtra Press restorations with individual layering.



FIG 2 A complete maxillary denture for a 70-year-old woman.

The challenge in producing these unique pieces is that each case is different. It is not possible to use the same material in the same way in different cases. Every case needs its own strategy. When technicians know the color of the prepared teeth and the volume of the restoration they can fabricate a truly successful restoration using specialized materials and workflows.

In this article I describe how the opacity, value, and translucency of ceramic layering powders are used in a specific case to create depth and a natural look in combination with a stable value.

Examples of Natural-Looking Results

In most cases at my lab, the technician meets with the patient before starting prosthetic treatment. It is the duty of the dentist and technician to find out what the patient wants. Of course everybody wants balanced, nice, and fresh looks. If all the teeth are being restored, it is possible to choose any level of brightness. If only a few teeth are being restored, patients will still want nice teeth, but most also prefer natural looks. Of course, preferences are patient specific. Do they prefer a unique look or do they want to look like just any Barbie doll? The balance between nice teeth and artificial masks depends on mastery of the dental materials and on how experienced the dental technician is with tooth morphology. The following examples showcase partial anterior restorations in which the individuality of the patients was maintained but the dentition was refreshed.

Figure 1 shows six Celtra Press (Dentsply Sirona) units with individual layering. The color value of the restoration material is higher than that of the untreated teeth, but the glassy material has a deep translucency, so the material with higher value doesn't reflect too hard. Also, the crown morphology is excellent and the proximal areas are warm and full of depth.

Figure 2 shows a complete maxillary denture fabricated for a 70-year-old woman. High-value Celtra Ceram and Creation LS (Creation Willi Geller) on Shofu Lucent Supra was used with contrast-rich layering. Bridge connectors were separated with an orange/pink mix to keep each unit visually distinct.

In Fig 3, four maxillary restorations made of IPS e.max MO 0 ingots are layered with Celtra Ceram and Creation LS. The high value is cohesive with the oral environment.

Figure 4 shows six Celtra Press maxillary restorations with a thin-layering Celtra Ceram. The canines match the natural teeth, whereas the anterior restorations are shinier than the mandibular lateral and central incisors. **[AU: Ok?]** Still, the deep Celtra translucency keeps it looking natural.

Figure 5 shows four maxillary Celtra veneers with a nice value and opacity. Though the hygienic situation of the patient might be critical, the veneers still fit nicely in the environment. The fresh look comes with changing the relation between body color and brighter parts of the natural teeth.

Figure 6 shows two maxillary Celtra veneers that perfectly match the oral environment, even the lips.



FIG 3 Four maxillary e.max MO 0 frames layered with Celtra Ceram and Creation LS.

FIG 4 Six maxillary Celtra Press units with thin-layering Celtra



FIG 5 Four maxillary Celtra veneers with nice value and opacity.



FIG 6 Two maxillary Celtra veneers with a perfect connection with the oral environment, even with the patient's lips.

Case Presentation

A woman came from a dental office that usually works with a different technician. Her preparation was already done, and she was wearing a chairside provisional restoration. This case was quite interesting because it had originally been done by a top-of-the-list technician in Düsseldorf in 2003/2004, with the case published in a

book from the German Association of Esthetic Dentistry. The technician who had done the case 20 years before didn't want to redo it, so the patient showed up in my lab and asked if we could do this restoration for her. She brought the book with the 20-year-old publication to give an idea of how the restoration had been and to show her expectations for quality (Fig 7). Of course this was a great chance to reset the list of popular technicians in the area.

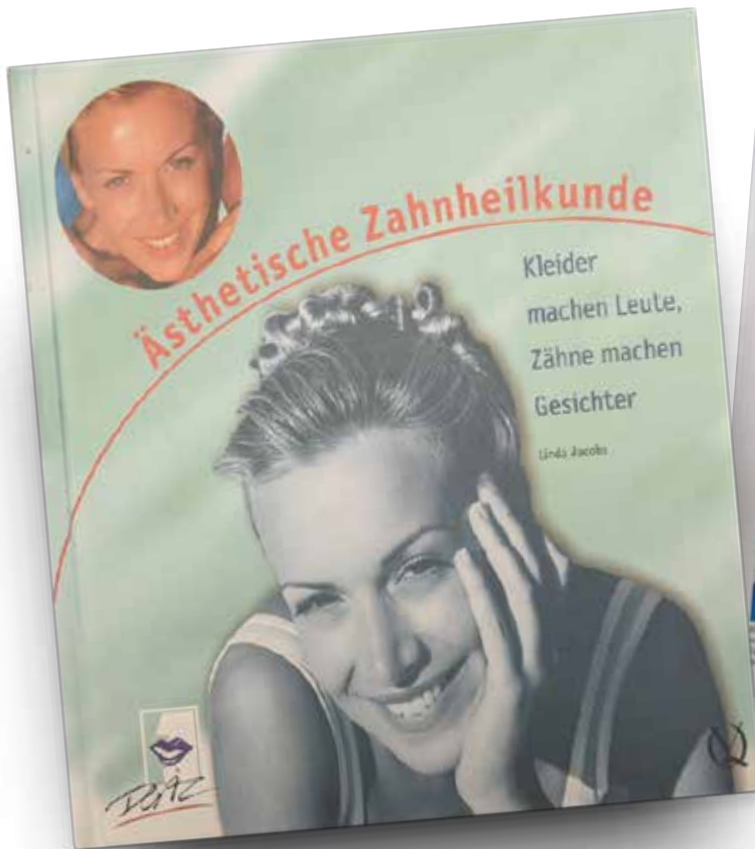


FIG 7 The patient showed up with a 20-year-old publication of her case. The case had been planned in a very unique way. (Reprinted with permission from Jacobs.)

Figure 8 shows the initial situation with the chairside provisional. All technicians and dentists working for Zahntechnik Düsseldorf follow the Easy Photo State guide for initial photograph documentation. This guide brings together all the information the technician needs for the work process. Because shade taking is done only for the dentin parts of the teeth, it is a good idea to position the shade guide horizontally at the same level as the teeth (Fig 9).

To plan an all-ceramic restoration and choose the right material, the technician must know the volume of the crown and the tooth color that is needed (Fig 10). The type of material determines the type of construction. For example, a lithium silicate crown needs a different shape than a zirconia crown, and a highly translucent zirconia crown might require a different shape than a less translucent one.



FIG 8 Initial situation with chairside provisional.



FIG 9 Horizontally positioned shade guide on the same level as the teeth.



FIG 10 Color of the prepared teeth.



FIG 11 The essential full-face photograph with closed occlusion and retractors. This picture can be imported into planning software and shows all the information needed to design the restoration shape.

Heavily discolored prepared teeth must be covered with a more opaque zirconia. Even IPS MO silicate frames appear glassy and can lead to a grayish shine. On the other hand, the optical qualities of naturally colored teeth can be used to support the effects of a more translucent material. Perhaps the most natural-looking crowns are created with pure porcelain such as Creation CC (Creation Willi Geller) layered on a refractory die. However, the dentist must be capable of cementing, and the flexural strength of porcelain is only around 120 MPa, which restricts its indications.

With a flexural strength of 550 MPa, Celtra Press is a very natural-looking form of zirconia-reinforced lithium silicate that can be layered with Celtra Ceram or Creation LS. Its advantages include stability and the ability to try it in and modify the material. It is also possible to integrate

it into a digital workflow such as printing and pressing. Prepared teeth with a natural color and bridgework require a frame material of more stable zirconia. I recommend ZR Lucent Supra (Shofu) because of its beautiful color and a flexural strength of more than 1,000 MPa, with indications for up to 14 restorations in a row.

Information about occlusion levels, pink/white esthetics, and line angles is essential to fabricate a satisfactory restoration. Therefore, a full-face photo with retractors and closed occlusion is needed. With this kind of picture, it is possible to plan and produce a restoration that fits the dental midline and vertical dimension of occlusion, [AU: Ok?] and it is also possible to import it into the digital construction (Fig 11).

Layering techniques

Layering of the four zirconia crowns starts with a 50:50 mix of PD5 (Orange Power Dentin) and DG2 (Reddish-Pink) from the Celtra Ceram system as a cervical frame up to the level of the interproximal contacts. The cervical third is covered with Celtra Ceram PD1 for a bony appearance (Fig 12), and the incisal edge is covered with PD3, a grayish Power Dentin (Fig 13).

From an occlusal view, it is important to fabricate the incisal edges with enough room for incisal effects and depth (Fig 14). The position of the incisal edges can also be organized at this stage.

Key to this layering technique is the bright central area, a subtle reflection from deep inside the restoration. A 50:50 mix of BL2 (Bleach Dentin) and EO6 (Bright Opal Enamel) from the Celtra Ceram system is placed under the dentin as well as into the enamel layer **[AU: Ok?]** and on top of the layering. This is referred to as the white/white mix (Fig 15).



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FIG 12 Orange and pink mix used in the cervical areas with PD1 used to mimic a bony body.

FIG 13 Celtra Ceram PD3, a grayish Power Dentin, used for the incisal edges.

FIG 14 Most important and most ignored: the incisal twist.

FIG 15 White/white mix for a high-value center.



15

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Figures 16 to 18 show the dentin layering process. The length of the final restoration is built up in dentin, while the body area is built up in final volume and the incisal third is reduced as much as the zirconia edge is covered. Fabricating an incisal twist is necessary for a natural-looking crown morphology.



FIGS 16 TO 18 Dentin layering.





FIGS 19 TO 21 Frontal and lateral views of the incisal edge that is fabricated by extending the length of the restoration with enamel.
[AU: Ok?]

The dentin layering is extended with Celtra Ceram enamel E2 and E3, which serves as the frame to place the internal effects (Figs 19 to 21). The cervical mix (PD5/DG2) is placed in the transition area between the dentin and enamel for a warm internal effect (Fig 22). Onto the warm internal mix, a brighter Power Dentin, in this case PD1, is placed in an irregular manner to create an eye-catching high/low reflecting internal effect (Figs 23 and 24).

A thin layer of EE2 (basically the translucent counterpart of Creation Willi Geller's Illusion in the Celtra system) is applied to the flanks of the crowns (Fig 25). Enamel E1 is used in the center, and E2 is used in the incisal area (Fig 26). The entire restoration is covered with CL-O from the Creation LS system (Fig 27), and the incisal halo is built up with Celtra Ceram PD1 again (Fig 28).



FIG 22 Orange and pink mix used for incisal internal effects.



FIGS 23 AND 24 PD1 placed over the orange and pink mix.



FIG 25 Illusion's counterpart, EE2 violet, applied to the crown.



FIG 26 Enamel E1 used in the center and E2 used in the incisal area.



FIG 27 The entire restoration is covered with Creation CL-O.



FIG 28 Incisal halo created with PD1.

After firing, grinding, and a first glaze bake but before manual polishing, the four units were tried in at the lab to get an idea of the final results (Figs 29 to 32). The outcome of the crowns with the cervical orange/pink mix and the incisal halo in combination with the soft internal effects was remarkable.

The idea in this experiment was to build up two versions of crowns—one version inspired by the crowns the patient had worn before and one version like that seen at the first try-in, with rather backstanding, slim central incisors. The second version fit the patient immediately and was the version the author preferred, but there was still another version to be tried.



FIGS 29 TO 32 Good outcome, shape, and incisal halo at the first try-in.

Figures 33 and 34 show the same basic layering in a slightly different position, this time fired before applying the enamel. The volume of the dentin core after firing is still quite undercontoured due to shrinking. Again, a layer of dentin is applied (Fig 35) and the volume in the body area is bigger than in the incisal third. The effects from the Creation LS system are highly fluorescent and very opaque compared with the Power Dentins of the Celtra system. MI-63 (Honey Yellow) and MI-61 (Ivory) are placed

in the incisal transition area in a manner similar to that used for fabrication of the first crowns (Fig 36). The layering is completed with Celtra Ceram Enamel E1 and E2 (Fig 37) and Creation LS CL-O (Figs 38 and 39). The surface of the porcelain must be controlled during layering so that it is smooth and plain before being placed into the Dekema Austromat. There is one golden rule for dental layering: You can only get out of the furnace what is put into the furnace! **[AU: Edit ok?]**



FIGS 33 AND 34 The same basic layering as the first version in slightly different position.



FIG 35 Dentin core.



FIG 36 In this version, the internal effects are fabricated with MI-61 and MI-63.



FIG 37 Enamel E1 and E2 used for the incisal third.



FIGS 38 AND 39
A smooth surface built up in CL-O.



Figure 40 shows the crowns after being fired and worked out before the glaze bake. Some corrections to form are still needed, and the black triangles need to be closed with the glaze bake. After manual polishing, the finished crowns are placed on the cast (Fig 41).

The zirconia crowns looked nicely integrated 2 weeks after cementation (Fig 42). The interproximal gaps were closed and the contrasts and layered filters covered the darker foundation of the prepared teeth in a natural way. The contrasts and intensity of the internal MI layering were quite marked, [AU: Ok?] but this is the special effect the patient liked a lot. From different angles with low light, the complex layering with contrasts of violet, white, orange, and the balanced dentin color is visible (Figs 43 to 45). The proximal contact lines are perfect, and the outcome is esthetic and flat while still supporting the gingiva. In photographs taken with more light and reflectors, the teeth appear shiny, balanced, and well integrated (Fig 46).



FIG 40 First try-in of the second version.



FIG 41 The finished crowns on the cast after manual polishing.



FIG 42 The zirconia crowns look nicely integrated 2 weeks after cementation.



FIGS 43 TO 45 In a low-light setting, the complex layering contrasts of violet, white, orange, and a balanced dentin color are visible. All proximal contacts are closed.



FIG 46 A photograph taken with more light and reflectors. The teeth are nice and shiny, balanced, and well integrated.

The surface of the restorations are smooth and still characterized (Fig 47). A photograph taken with a polar filter (Polar-Eyes, Bio-Emulation) reveals the value of the crowns (Fig 48), which is not necessarily much higher than that of the natural teeth but just spread over a bigger area than the surrounding teeth, which makes the crowns look fresh and bright yet still visually connected with the oral environment (Fig 49).



FIG 47 The surface is smooth and still characterized.



FIG 48 A Polar-Eyes shot.



Reference

1. Jacobs L. Ästhetische Zahnheilkunde: Kleider machen Leute, Zähne machen Gesichter. Quintessenz, 2004.



FIG 49
A natural smile—
just beautiful.