Minimalism in all-ceramics:
Micro-layering rethought

By **MDT Dmitrii Kisel**, Germany

Dmitrii Kisel studied dental technology at the Medical School in Kirov (Russia) from 2006 to 2009. After graduating, he worked as a dental technician at the Blik dental clinic in Kirov for almost three years. In 2011, he took up a position at the Imesa dental clinic in Moscow. In 2015, he moved to Germany to work in the dental laboratory "Krenz-Dental" in Frankfurt am Main. In June 2016, he took up a position in the practice laboratory of the Palli Dentalzentrum in Baden-Baden (Germany), where he is still working as a dental technician. Since 2020, he also has his own laboratory in Baden-Baden. In 2016 he became a member of the Russia (Smile Style Association and in 2018 of the dental technician guild "Damaged Goods". Since 2019, he has been preparing for his master craftsman's examination at the "Bildungsakademie Karlsruhe". Dimitri Kisel has extensive CAD/CAM knowledge (3Shape, Cerec and thus also inLab), and is specialized in all-ceramics, but also metal-ceramic restorations, implant prosthetics, resin technology and total prosthetics are part of his activities. He works with dental practices worldwide (USA, Russia, EU); His cases have been published in various magazines, in several countries.

"Less is more" – most often, this minimalist approach can also lead to the goal in the dental laboratory. In particular, it is a matter of rational use of resources, e.g. one's own labour, and thus being able to save valuable time. Ideally, the quality of the result remains unaffected. The author of the article uses two case studies to describe how micro-layering with Initial™ IQ ONE SQIN (GC) can lead to the goal in an efficient way. He presents two different paths. One restoration was finalised using a combined staining technique. In the other example, micro-layering was used to create the illusion of depth after a "lingual cut-back".

The all-ceramic laboratory routine presents a wide variety of challenges. Each patient case is different and requires an individual approach. What is always the same is the demand to reach the goal as efficiently as possible without getting bogged down by a multitude of materials and products. Different approaches are possible, depending on the case. While, for example, a single anterior tooth usually requires ceramic layering according to all the rules of the art, other restoration types can be implemented in a simpler way. The dental technician specialising in all-ceramics should be proficient in both procedures. The prerequisite is an understanding of function and aesthetics as well as knowledge of light-optical phenomena that characterise natural teeth. In addition, a suitable material concept is required. GC has established the Initial™ IQ ONE

SQIN painting and micro-layering system for the versatile demands of the all-ceramic dental laboratory. For 20 years, the company has been dealing with the question of how to reduce the effort of the ceramic layering technique. Experience values were combined with modern material technology.

Fig. 1: The GC Initial™ IQ ONE SQIN (GC) painting and micro-layering system offers various options so that the appropriate finalisation concept can be selected according to the initial situation.

The result: Initial IQ ONE SQIN - a coordinated concept consisting of three different ceramic materials (Fig. 1). The 3D ceramic glaze pastes Initial™ IQ Lustre Pastes ONE are used to characterise the framework and simultaneously function as the connection firing (internal or external staining). The pastes are similar in consistency to liquefied veneering ceramics, offer natural fluorescence and can also be used to create a subtle 3D-effect. As universal 2D stains, the Initial™ Spectrum Stains enhance individual characteristics and can reproduce a variety of shades. In addition, the set integrates a low-fusing fine-grained veneering ceramic to layer the anatomical shape: the micro-layering ceramic Initial IQ SQIN is used to design the morphology and surface texture.

Minimalism is relative

"Less is more"; especially when it comes to reducing one's own workload, is a welcome promise. It should be noted that minimalism can be interpreted just as individually as aesthetics. It is a subjective feeling. What is considered minimalistic for one dental technician may still be too much for another. It is therefore important to define one's own workload individually and to determine one's own path on a case-specific basis. A material concept such as the Initial IQ ONE SQIN painting and micro-layering system keeps all doors open. Two minimalist working approaches for fabricating dentures on a zirconium oxide framework are presented below.

Framework material as the basis for micro-layering

From one perspective, a monolithic approach to zirconia crowns and bridges is efficient. Moreover, a high

stability of the restoration is achieved by the fully anatomical design. If the staining technique with all its subtleties is mastered with confidence, visually attractive results are possible. It is important to select the framework material correctly, because this forms the basis for any finalisation procedure. The focus is on the light-optical phenomena translucency and opacity as well as the base colour of the material. If a very light tooth colour (e.g. A1, A2) is desired for a restoration, correspondingly light and translucent zirconium oxides are recommended. If the reference teeth have a slightly greyish tone, a C1 shade usually provides a good base for the subsequent individualisation.

For this article, two dental arches were characterised with the Initial IQ ONE SQIN micro-layering system to demonstrate what can be achieved, even within a very thin layer. Two different zirconium oxide materials were used, which differ greatly, especially in opacity and colour gradient. While a multi-layered material was used for the restoration in the upper jaw, a monochrome zirconia with high strength was used for the lower jaw restoration. Especially in situations where stability needs to be high, a translucent zirconia should be avoided, as the bending strength is reduced. A multi-layer material with gradients in flexural strength will have a lower strength than high-strength monochrome materials (e.g. 1.100 MPa). In order to still create a translucent effect, it may be useful to apply effect liquids before sintering, for example.

Combined painting technique: Monolithic zirconia framework from 44 to 34

Minimalism concept
The restoration for the lower jaw from

tooth 44 to tooth 34 was to be finalised using the combined staining technique. Minimalism in this case means that the teeth remain unveneered and the monolithic zirconium oxide framework is superficially finished with Initial IQ Lustre Pastes ONE and Initial Spectrum Stains. On the other hand, the gingival part should be veneered with a thin layer (approx. 0.2 - 0.3 mm) (Initial™ IQ SQIN).

Framework production

Monochrome, high-strength zirconia was selected for the framework (Fig. 2). The transparency of the material is about 45%. In order to optimise the aesthetic properties - especially the translucency - effect liquid was applied with a brush to the incisal edges before sintering (Fig. 3). The liquid diffuses into the zirconia surface during sintering and makes selected areas appear more transparent (Fig. 4).

Fig. 2: Monolithic, monochrome zirconium oxide framework for the mandible in the green state

Fig. 3: Before sintering: applying effect liquid to the incisal edges

Fig. 4: After sintering: increased apparent translucency of the incisal areas

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1 Flexural strength should be at least 500 MPa for 3-unit bridges and 800 MPa for 4-unit bridges

The strength of the framework is not affected. After sintering, the zirconia surface was lightly reworked with the rubber polishers and gently blasted with glass beads (pressure: 2 bar).

Finalisation

Initial IQ Lustre Pastes were applied as the first layer; the Initial Lustre Pastes NF GUM (non-fluorescent) were used on the gingiva, while the Lustre Pastes ONE, exhibiting fluorescence like like natural dentition, were applied on the teeth. To give the gingiva a good base layer, LP-M2 (Modifier Red) and G-24 (Lustre Pastes NF GUM Base Dark) were used (Fig. 5). The mixture was applied in depth between the root portions of the teeth. The areas that needed to be much lighter were designed with a mixture G-35 (Lustre Pastes NF GUM Intensive Cream) and G-23 (Lustre Pastes NF GUM Base Light).

The first firing was followed by the veneering of the gingiva with the three gingiva materials of the Initial IQ SQIN System (1. Gingiva GUM neutral - transparent and colourless, ideal to mix and match with the other GUM shades, 2. Gingiva GUM light - considerably more opaque and slightly pinkish, 3. Gingiva GUM dark - opaque and slightly

Fig. 5: Priming the gingival areas with Initial IQ Lustre Pastes ONE (GC)

Fig. 6: Veneering the gingival areas with Initial IQ ONE SQIN (GC)

pinkish-purple in colour). To achieve a vivid effect, the light and dark shades can be mixed with neutral material (Fig. 6). Between the teeth, a mixture of Neutral, Dark and Light colours was used to create the colour effect. Depending on the need, the colour effects can be intensified with LP-M2 (Modifier Red) of the Lustre Pastes NF GUM Set.

Fig. 7: Coating the gingival areas with GUM Light and GUM Neutral and applying a natural-looking texture

Afterwards, the entire surface was covered with a layer of GUM Light and GUM Neutral to give the gums an anatomical structure and texture (Fig. 7).

Finally, the fully anatomically milled teeth were individualised with Lustre Pastes ONE (L-V Value, L-7 Incisio, L-10 Twillight, L-A, L-B) (Figs. 8 and 9). If morphological characteristics are missing, refinements can be made with Lustre Pastes ONE L-N (Neutral) or L-Opal. After firing, the surface appeared silky matt. The Lustre Pastes and SQIN masses formed an overall shape and structure. If necessary, the surface texture can be finished with rotary tools. Small shape corrections with appropriate rotating diamond tools are also possible at this stage.

Finally, a correction firing for shape and colour followed. For example, small subtleties in the gingival area were completed with Lustre Pastes NF GUM Shades. The surface of the teeth was optimised with L-N or L-Opal. After the additional firing, a subtly glossy surface was revealed, which can be polished by hand with rubber polishers, brushes or diamond paste for an

Figs. 8 & 9: Completed restoration. The fully anatomical teeth were customised with Initial IQ Lustre Pastes ONE (GC).

enhanced optical effect, if required.

Lingual cut-back technique: Monolithic zirconia framework from 13 to 23

Minimalism concept

The restoration for the upper jaw from tooth 13 to tooth 23 was to be finalised using the lingual cut-back technique. Minimalism in this case means that the basic shape of the teeth is defined by the monolithic zirconium oxide framework, but some volume is removed in the lingual area to make room for light-absorbing materials to achieve a depth effect. Ideally, warm grey shades (e.g. L-3, L-4, L-10, L-7) are used for this purpose. Ultimately, a high degree of naturalness should be achieved when completing the shape with Initial IQ SQIN. In general, a thin layer of TO-Opal Booster or Enamel is sufficient to achieve a beautiful 3D look.

Framework production

A multi-layered zirconium oxide in shade BL3 was selected for the framework. The transparency of the material increases towards the incisal edge. To give the anterior teeth a deep liveliness from within, a lingual cut-back was carried out (Fig. 10). For this purpose, volume was removed in the lingual area before sintering.

Fig. 10: Before sintering: monolithic zirconia framework with a lingual cut-back

Fig. 11: Filling the lingual cut-back with Initial Spectrum Stains and Initial IQ Lustre Pastes ONE (both GC) for a natural depth effect (light transmission).

Fig. 12: Framework preparation for finalisation.

Fig. 13: Layering of the gingiva with a mixture of GUM Dark, Light and Neutral materials.

Fig. 14: Shape corrections with Initial IQ SQIN.

Conclusion

Two minimalistic concepts for all-ceramics were shown, both of which have one goal: efficiency without aesthetic compromise. The pictures of the finished restorations (see Figs. 8, 9 and 15) speak for themselves. Both restorations were customised and finished on a monolithic milled zirconia framework using the GC Initial™ IQ ONE SQIN micro-layering system. Thanks to the 3D stains (Lustre Pastes) and the IQ SQIN veneering ceramic, a good result could be achieved without complications. If necessary, shade adjustments can be made with Initial Spectrum Stains. A major advantage of the shown procedure is that both veneering ceramics and 3D stains have excellent colour and shape stability, even after several firings. This increases the efficiency and/or reduces the workload without compromising the result. The approach always needs to be defined on a case-specific basis. A material concept such a s the Initial IQ ONE SQIN painting and micro-layering system from GC keeps all doors open and this is precisely what makes it so convenient to use.

It is important to handle the grinding instruments carefully, because zirconium oxide is very sensitive, especially before sintering.

Finalisation

After sintering and conditioning the zirconia surface, blue-grey stains from the Initial Spectrum Stains and Initial IQ Lustre Pastes ONE were added on the parts/areas of the framework removed for the cut-back. The result is a depth effect created by light transmission (Figs 11 and 12). While the actual tooth shape remained unchanged, the optical properties could be improved in this simple way. The design of all anatomical features of the teeth as well as the gingiva resembled the procedure in the previously shown case study (Figs. 13 and 14). If necessary, shape and texture can be added with the Initial IQ SQIN veneering ceramic. Four dentine shades (A, B, C, D), a Bleach dentin, enamel shades and an opal booster

are available. In this case, a small shape correction was executed with a 1:1 mixture of E-57 and Translucent Opal Booster. The gingival portions were layered with a 1:1:1 mixture of GUM Dark, Light and Neutral. After glaze firing, they were manually polished to increase the degree of gloss (Fig. 15).

Fig. 15: The finished restoration after adjusting the gloss level. Monolithic zirconia restoration with natural-looking depth effect and dynamic micro- and macrotextures.