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New philosophies in ceramic layering

By Joaquín García Arranz (Quini) and Dr. Ramón Asensio Acevedo, DDS, Spain

Micro-layering is a solution that combines full-body ceramics with a very thin layer of veneering ceramics in the buccal, aesthetic zone. With current CAD-methods, a buccally reduced restoration is modelled in a jiffy. With the right materials, color deepness and natural translucency can already be obtained within a space of about 0.2 to 0.6 mm. Hence, the strength of the framework remains where needed, and within this small space, color as well as shape and (micro-)texture are easily controlled.



Figs. 1a-c: Initial situation: **a)** Front view; **b)** Right lateral view; **c)** Left lateral view.

Diagnosis and treatment plan

The patient consulted his dentist because he was dissatisfied with his smile. He also mentioned some pain in the upper frontal area.

During the clinical examination, it was noted that left lateral incisor was absent, which resulted in a large midline shift in the upper jaw. A fixed porcelain-fused-to-metal restoration was present on teeth 1.2, 1.1 and 2.1. Tooth 2.1 suffered periodontal loss of attachment and a large vestibular gingival recession was present (Figs. 1a-c). The current dental situation was causing occlusal instability, inadequate function and poor aesthetics.

The treatment plan consisted of an initial prophylactic phase including oral hygiene instructions and extraction of tooth 2.1. and all necessary actions were taken to stabilize periodontal health. Once stabilized, a second phase was carried out, in which orthodontic aligners were used to correct the midline shift and to redistribute the spaces for placing an implant at the locus of tooth 2.1 (Fig. 2). The last phase consisted of the prosthetic rehabilitation of the upper anterior teeth, with veneers on teeth 1.3 and 2.3, an extension bridge from 1.2 to 2.1 with a pontic on the locus of 2.2 (Fig. 3).

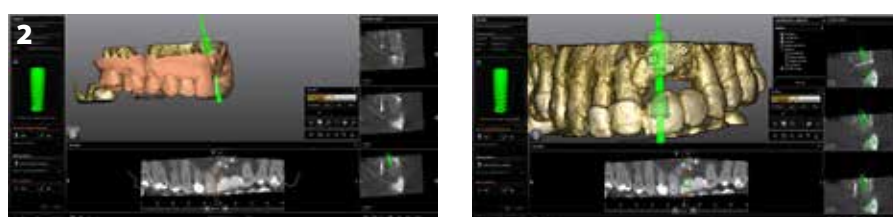


Fig. 2: Digital planning of the surgical phase

In such a particular case, combining teeth and implants in the anterior region, it's important to select the most suitable restorative material in terms of strength as well as aesthetics and carefully consider the restorative design, obtaining the maximum profitability for its integration.

Surgical intervention

After the orthodontic treatment with aligners, the marked bone defect caused by a long-evolving infection at the locus of tooth 2.1 was regenerated.

For this intervention, autologous bone was chosen for the guided bone regeneration, being considered the "golden standard". The SBB (split bone block) technique was used, initially described by Khoury *et al.*¹ This technique consists of obtaining a bone graft of the jaw branch that is subsequently divided into two cortical sheets that are fixed in the defect area by screws, and then autologous bone scratched from the bone graft itself is placed between the two sheets.



Fig. 3: Digital planning of the prosthetic restoration

The intervention is concluded with a tension-free closure using stitches in the area (Fig. 4).

Four months after the horizontal ridge augmentation, the implant was placed in the regenerated area using guided surgery (Fig. 5). When this area was exposed, a horizontal gain of bone was found. After implant placement, the volume of soft tissue was optimized by two connective tissue grafts; one from the palate and one from the tuberosity region.

Restorative design

A standard, prefabricated abutment that could be modified by grinding was chosen (Fig. 6a). Small modifications were made, that were however of great importance. The abutment was customized by under-contouring the subcritical area as much as possible, modifying the margins, especially the mesial margin and lengthening the distal area, to have sufficient support for the secondary structure to rest on (Fig. 6b).

Zirconia was chosen for the restoration framework from 2.2 to 1.2. This material allows to make the design in the subcritical area of the emergence profile as undercontoured as possible, following the design of the abutment interface to create a fully polished, seamless profile, providing a smooth surface in contact with the mucosa.

In the design, the full volume was kept on the palatal side to ensure a durable restoration over time and to avoid chipping problems due to protrusive or lateral movements.

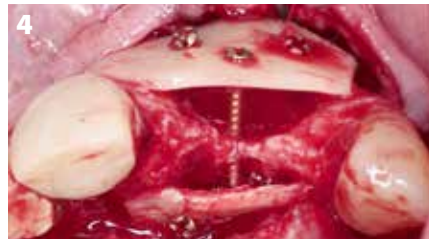


Fig. 4: Horizontal ridge augmentation with autologous bone using the split bone block technique¹.



Fig. 5: Guided implant surgery



Fig. 6: a) Standard abutment; **b)** Modified abutment



Colored zirconia was as used with the same substrate or nuance of the patient's base dentin, which was A3 in this case. A micro-reduction of about 0.2-0.3 mm was created at the vestibular side for future micro-stratification (Fig. 7).

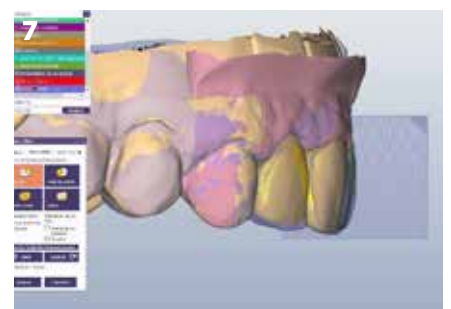


Fig. 7: Digital design of the restorative framework in zirconia



Fig. 8: Fluorescence of the Initial IQ Lustre Pastes ONE

Characterization: internal staining

Nowadays, a wide range of possibilities exist to characterize ceramic restorations. The combination of Lustre Pastes ONE and Spectrum Stains provides the ability to establish all color effects, both internally and externally.

A great difference can be seen in comparison to the older paints and stains, with much more luminosity and incredible fluorescence (Fig. 8).

Once sintered, the framework was prepared on the model, the occlusion verified and so it was ready for micro-layering.

The internal staining was done with a combination of Lustre Pastes ONE with Spectrum Stains to intensify some color details.

To mimic the mamelon structure, a combination of SPS-13 (Twilight) and SPS-16 (Midnight) was used. Next, the incisal halo was accentuated using a mixture of SPS-1 (Ivory White) and SPS-2 (Melon Yellow).



Fig. 9: a); b) Close-up of the zirconia framework. Color was added with a mixture of Initial IQ Lustre Pastes ONE and Initial Spectrum Stains.

Mesially and distally of the incisal edge, Lustre Pastes ONE Body A mixed with either SPS-2 or SPS-4 (Light Terracotta) were alternatingly applied for bright contrasts and saturation, respectively. Further mesially and distally up to the cervical margin, L-6 (Dark Blue) was used. In the middle and cervical third, Lustre Pastes ONE Body B was used to give the zirconia framework a bit more saturation; here, SPS-13 was used on either side of the centrofacial lobe to further accentuate the developmental depressions towards cervical.

Layering: form and texture

Once the Lustre Pastes are fired in the furnace, all colors are fixed in place and serve as a connection layer. Depending on the chosen shade, this can be done in multiple firings. After the internal characterization, a texturizing ceramic material (Initial IQ SQIN) that was introduced together with Lustre Pastes ONE and Spectrum Stains as a new innovative concept was used to add shape, texture and gloss. A great advantage of this concept is that the same ceramic can serve for different restorative materials, such as zirconia and lithium disilicate.

The area of the mamelons was layered with Translucent TO (Opal Booster) combined with the enamels E-57 to E-59. Translucent TO was also used for the line angles of the tooth.

Since the zirconia was precolored in the base color, there was no need to add dentin ceramic; only a thin enamel layer was applied (Fig. 10).

The SQIN ceramics are much easier to handle than a conventional ceramic as the feeling on the brush is very consistent. Due to the Form & Texture liquid, it stays very well on any surface where it is placed at and compared to other ceramics, there is virtually no shrinkage. In case of zirconia, the restoration is fired at a temperature of approximately 760°C, depending on the furnace.



Fig. 10: The finished zirconia restoration, characterized with the Initial IQ ONE SQIN system.

11a



11b



Fig. 11: Lithium disilicate veneers on teeth 13 and 23. The characterization was done with the Lustre Pastes ONE and Spectrum Stains from the same Initial IQ ONE SQIN system as was used for the zirconia bridge.

As the final phase, lithium disilicate veneers (Fig. 11) were made on the canines combining the Lustre Pastes ONE with the Spectrum Stains.

The great advantage of the micro-buccal layering is that adding texture is much easier than on full-body lithium disilicate or zirconia, which is more difficult to manipulate because of its extreme hardness, even though SQIN is more dense than conventional veneering ceramics. It allows to control the luminosity and the fluorescence, seeing a noticeable difference in blacklight or fluorescent light after finishing the surface, making it resemble the natural tooth (Figs. 12 and 13).

12a



12b



12c



Fig. 12: a) Occlusal view after removal of the provisional screw-retained restoration, showing the obtained gingival architecture; **b)** After placement of the restorations; **c)** Transillumination of the restorations.

13



Fig. 13: Final result (front view), showing a natural-looking and harmonious dentition.





Fig. 14: **a)** Adding color to the gingival area with Initial Lustre Pastes GUM; **b)** Adding texture with Initial IQ SQIN GUM; **c)** The finished gingival area nicely shows an 'orange peel effect'.

Gingiva

The Initial IQ SQIN GUM shades also enable us to use ceramics for atrophied jaw restorations where we need pink aesthetics. Combined with the Initial IQ Lustre Pastes GUM shades, the main color is intensified first (Fig. 14a).

This system enables micro-layering with the same philosophy as for the white aesthetics with different shades of color, adding subtle contrasts with its different masses, adding details to the surface (Fig. 14b) such as an orange peel effect (Fig. 14c).

Conclusion

With the Lustre Pastes ONE characterization serving as a connection layer, the SQIN ceramics to refine the form and texture and the Spectrum Stains for infinite shade variations, only a minimal cut-back on the vestibular part is needed to control the texture, fluorescence and transillumination for mimicking natural teeth. Adding the possibility of the same concept for pink aesthetics with the GUM shades, we have a complete concept at our hands.

Reference

Khoury F, Hanser T. Three-Dimensional Vertical Alveolar Ridge Augmentation in the Posterior Maxilla: A 10-year Clinical Study. *Int J Oral Maxillofac Implants*. 2019 Mar/Apr;34(2):471-4