Mind the gap: Two different paths to one goal

Aesthetic gap closure in the upper anterior region

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Johannes Bantleon *completed his dental training at the Bernhard Gottlieb University Dental Clinic in Vienna. He gained extensive work experience in private practices in London, where he enjoyed most of his postgraduate education. His treatment focus is on aesthetic-restorative dentistry with minimally invasive techniques. In doing so, he relies on the principle of biomimetic dentistry – a substance-sparing form of treatment with the aim of restoring the original function and aesthetics of teeth and gums as close to nature as possible. Since 2018 he has been working as a dentist in the group practice "Ordination für Zahnerhaltung" in Vienna.*

For the aesthetic optimization in case of diastema, the direct (dental practice) can be distinguished from the indirect procedure (dental laboratory). On the basis of two patient cases, the author presents his approach and explains in which situations he prefers indirectly manufactured ceramic veneers (e.g. , lithium disilicate Initial LiSi Block, GC) and when he resorts to direct veneering with composite (e.g. light-cured universal composite Essentia, GC).

If gaps are to be closed in the anterior region, the decision on the type of restorative pathway (direct or indirect) is guided by objective (e.g. materials science) and subjective factors (e.g. patient-specific aspects). A particular challenge is the closure of a gap between the two middle front teeth in the upper jaw.

Composite vs. ceramics

The developments of tooth-coloured materials as well as adhesive technology enable minimally and partly non-invasive aesthetic rehabilitation. A ceramic restoration is often the preferred option for restorations of anterior teeth. However, this seems too one-sided in view of modern, highly aesthetic composites.

Direct veneering with composites

Parallel to the further development of ceramic materials, restorative composites have made remarkable progress. Modern composites impress with sophisticated filler and matrix properties due to colour and reflection features that come close to those of a ceramic. In addition, material properties have been optimized, resulting in good long-term stability. The potential of modern composites is great. For a long time now, the focus lies not only on carious lesions, but also on aesthetic indications.

Indirectly manufactured veneers with ceramics

The aesthetic potential of ceramics, as well as their mechanical properties, are arguments for the indirectly manufactured veneers. By means of adhesive technology, even paper thin ceramic facets can be safely cemented in the mouth and with long-term stability. Modern press or CAD/CAM ceramics (e.g. lithium disilicate ceramics) enable individual aesthetic implementation in an efficient way.

Mock-up as a basis for treatment success

Each treatment plan is based on a functional, structural and aesthetic analysis, including functional diagnostics, photo status and study models. The diagnostic wax-up reflects the aesthetic change and serves as the basis for the mock-up. This can be made via a silicone key in the patient's mouth. The alternative is the laboratory-made version. The mock-up is verified in the mouth by the patient; this test run is sometimes the most important step of the treatment. It facilitates the aesthetic-functional implementation, since the form tested in advance and confirmed by the patient "only" has to be copied and thus one can focus on the aesthetic and functional design.

Patient cases: direct and indirect approach

The decision for the restoration concept is dependent on subjective factors in addition to objective material properties. The answer to the question of the "perfect" material is primarily given by the patient through the initial situation. Decisions are made according to patient-specific criteria, such as age, clinical initial situation (bruxism, abrasion, erosion, etc.), aesthetic demands, costs. In addition, the skills and experience of the prosthetic team influence the decision-making process.

Direct: Production of veneers in the dental practice

The direct production of veneers as an additive process is defect-oriented and minimally invasive. The desired result can be realistically visualized. In addition, the direct restoration can be adapted at any stage of production. If a correction or repair would be necessary later on, this is possible with comparatively little effort. Ultimately, the lower costs are to be mentioned as advantageous.

- Minimally invasive approach
- Option to adapt at any stage of production
- High aesthetics (depending on the material) and long durability with modern high-performance composites
- Easy repair option
- Reduced manufacturing effort (time savings) and lower costs for the patient
- Completion (layers, polishing) usually completed in one or two sessions

However, the direct construction of the teeth is technically demanding and requires a certain aptitude, sense of aesthetics, sound knowledge and experience. Materials science must also be included in the decision, especially in functionally important areas such as the occlusal surface or the incisal edge. Despite highly developed composites, ceramics are superior in some respects (e.g. abrasion resistance). In addition, composite is subject to shrinkage. Its surface roughness is also higher compared to a ceramic. In order to keep adhesion factors for microorganisms and discolouring particles on the composite surface to a minimum, careful finishing and polishing as well as very good oral hygiene are required.

Direct veneering with composite (Essentia, GC)

The patient wanted the anterior tooth position in the upper jaw to be harmonised (Fig. 1). The gaps between the teeth were to be closed, combined with tooth whitening.
The implementation needed to be done at a manageable expense for the patient in the dental practice. It was decided to veneer the teeth in a direct way.

Planning

A diagnostic wax-up was made in the dental laboratory as an indispensable basis for any aesthetic restoration.
Due to the approximate widening of teeth 13 to 23, an aesthetic gap closure could be achieved. The idealized wax-up was the basis for the direct

Fig. 1: Multiple diastema in the anterior upper jaw

Fig. 2: Directly manufactured mock-up to assess functional and aesthetic criteria

Fig. 3: Conditioned enamel surfaces

Fig. 4: Build-up of the incisal edge with translucent composite (Essentia LE)

Fig. 5: Layer of the other composite masses (Essentia MD and LD) within the contour frame

mock-up (tooth-coloured bis-acrylic composite) (Fig. 2). After assessment of the functional, phonetic and aesthetic parameters, the patient confirmed the desired outcome.

Material selection

Essentia (GC) was chosen as the composite. One advantage of the material is the colour concept. While other composites often reproduce classic tooth shades, the shade concept is redefined here and intuitive to handle. Natural teeth do not have only one colour, but vary in many ways in their light-optical details (translucency, opalescence, chroma, brightness, saturation, etc.). In order to reproduce this with composite, a suitable material is required. Essentia makes it easy to recreate these natural structures. The dentine shades are sufficiently opaque for the first layer and are easy to shape. On the other hand, the enamel shades have a wonderful translucency. At the same time, these pastes are somewhat stiffer and denser, resulting in a good surface structure and an easy-to-polish surface with a long-term stable, high gloss level.

Implementation

The rubber dam placement, sandblasting (29 µm aluminium oxide), etching of the entire enamel surface and application of a light-cured one-component adhesive, were followed by the layering (Fig. 3). It has proven successful to first build up the palatal wall as well as the incisal edge and marginal ridges with a translucent composite (Essentia LE) (Fig. 4) This way, the subsequently layered opaque portions nicely come into their own. Within the contour frame, the other composite compounds were applied (Fig. 5). In this case, the teeth have been designed relatively opaque (Dentin shade Essentia MD and LD). When the composite is slightly heated in advance, it is easier to sculpt. After polymerization, the focus was on the finishing (Figs. 6 and 7). The following applies: it is the perspective that counts! The surface morphology of a tooth determines its reflection properties and thus the aesthetic shade perception. Fine nuances in the microtexture and a graceful interplay of concave and convex surfaces convey naturalness. A delicate surface structure of perikymata – fine, wavy structure in a horizontal direction – and vertically running transitional lines give the tooth liveliness. After having checked the function and aesthetics, the polishing was carried

Fig. 6: Marked transitional lines and incorporation of the surface texture (reflection behaviour)

Fig. 7: Gap closure realized directly at two years after treatment

Fig. 8a and b: Comparison before/after

out in a separate session (green&red flame-shaped diamonds/Astropol blue, Ivoclar Vivadent/pink&grey polishers, EVE/GC Diapolisher Paste with felt wheel). On one hand, a smooth, dense surface can be achieved. On the other hand, the incorporated surface structure should not be smoothed out during polishing. Since the excellent polishing properties of Essentia, this can be achieved efficiently and with a permanent gloss level. The result is an implementation in line with the planning. The tooth shapes fit well to the patient's face. Tooth colour, light optics and surface texture corresponding the patient's wishes could be fulfilled in the dental practice with direct veneers in a short time and in an economic way (Fig. 8).

Indirect: Production of ceramic veneers in the dental laboratory

The indirect production of ceramic veneers becomes the method of choice for the highest patient demands, possibly combined with functional challenges. Ceramic veneers have excellent wear resistance and - depending on the product - an optimal surface quality. In addition, due to the indirect production in the articulator or in the digital workflow, functional aspects can be taken into account in all respects. At the same time, ceramics impress with good soft tissue compatibility.

- Highest aesthetics (depending on the material and dental process technology)
- Long shelf life
- Gingiva-friendly and resistant to discolouration
- High wear resistance
- Minimally invasive implementation (adhesive bonding)

However, laboratory-made veneers are complex to produce and therefore expensive. The restorative outcome depends on the skill of the dental technician. Very good knowledge of aesthetic dentistry and adhesive technology is required. In the case of chipping, a fracture or the need for an aesthetic adaptation, the procedure is more difficult. In addition, the intraoral cementation (adhesive cementation with rubber dam, pre-treatment of the restoration and teeth, etc.) is technically complex.

Indirect all-ceramic veneers (GC Initial LiSi Block, GC)

The patient consulted the practice with the desire for an aesthetic improvement in the upper front tooth area (Fig. 9). In particular, the teeth 22 on 12 were narrow and peg-shaped. Due to the space available and the quasi "given preparation", indirect veneers were chosen and thus all-ceramics were preferred. The choice fell on Initial LiSi Block (GC).

The fully crystallized lithium disilicate ceramic has optimal physical and aesthetic properties without the need for firing. Thanks to subtle light-optical properties and diffuse translucency, teeth with their versatile internal structure can be imitated wonderfully. The remarkable opalescence of the ceramic results in colour trueness and aesthetic integrity.

Planning

Photo status, functional analysis, etc. – the planning phase is always identical. Since the all-ceramic veneers were to be produced digitally here, the mock-up was already digitally produced (CERASMART270, GC) and tested in the patient's mouth (Fig. 10).

Preparation

On teeth 13 to 23, only the incisal edges had to be subtly rounded (Fig. 11). After a conventional impression, the veneers were milled in the dental laboratory.

Laboratory preparation and implementation

On teeth 13 to 23, only the incisal edges had to be extremely finely rounded (Fig. 11). After a conventional impression was taken, the veneer was fabricated in the dental laboratory. The veneers were milled from GC Initial LiSi Block (GC) in shade A1. This was followed by the corresponding laboratory steps and the completion

Fig. 9: Backward tooth position in the upper jaw with cone teeth (11, 21)

Fig. 10: Indirectly made mock-up (CERASMART270, GC) to control functional and aesthetic aspects

Fig. 11: Minimally invasive preparation of teeth 13 to 23 (enamel limiting) and preparation for impression

Fig. 12: Enamel surfaces conditioned for adhesive cementation (11, 21)

Fig. 13: Luting of the veneers (G-CEM Veneer, GC) on teeth 11 and 21. Excess removal was done with a microbrush.

Fig. 14: Diastema closure in an indirect way (six laboratory-made veneers)

of the ceramic veneers. High gloss was achieved by simple polishing. If desired, individualizations with veneering ceramics or ceramic stains are a possibility as well.

Cementation and result

The veneers were prepared for adhesive attachment and the tooth surfaces were cleaned. This was followed by isolation with rubber dam. The teeth were cemented with a light-cured resin composite cement (G-CEM Veneer, GC) in the colour A2, preceeded by total etching. The thixotropic material offers pleasant handling; it neither flows away, nor sticks to the syringe. Rather, it can be applied "lightly" and controlled. The veneers can be precisely positioned on the tooth and cemented with a perfect fit. As it is a purely light-curing material, the processing time of G-CEM Veneer is sufficiently long. In this way, several veneers can be cemented simultaneously (Fig. 12 and 13). The cementation and excess removal was followed by a final evaluation of the functional parameters.

Note: It is recommended to use the products of one manufacturer for adhesive luting. In addition to the G-CEM Veneer cement, GC offers the universal bonding G-Premio BOND (adhesive for the tooth surface) and the universal primer G-Multi PRIMER (primer for the restoration surface).

The result corresponded to the patient's wish. The straightforward design of the teeth with the rectangular contours fit well into her face (Fig. 14). Also the slightly brighter yet warm tooth colour is very pleasing (Fig. 15). With Initial LiSi Block,translucency and brightness can be controlled by selecting the block. In addition, there is the possibility of individual characterization by Initial Lustre Pastes & Spectrum Stains (GC). The warm colour of the natural tooth and the translucency and opalescence of the ceramic interact with each other. The patient's wishes could be fulfilled with indirectly manufactured veneers.

Result

Various methods are available to optimize a diastema closure. The direct procedure (dental practice) with the light-curing universal composite GC Essentia and the indirect way (dental laboratory) with the lithium disilicate ceramic GC Initial LiSi Block were presented. Whether it's composite or ceramic – even if they are two fundamentally different materials - an excellent aesthetic result can be achieved. The basis is the understanding of natural teeth and their biology, function, morphology and light optics. Dentists have the great opportunity to "study" the structure of teeth live on a daily basis; a good basis for obtaining orientation in restorative treatment.

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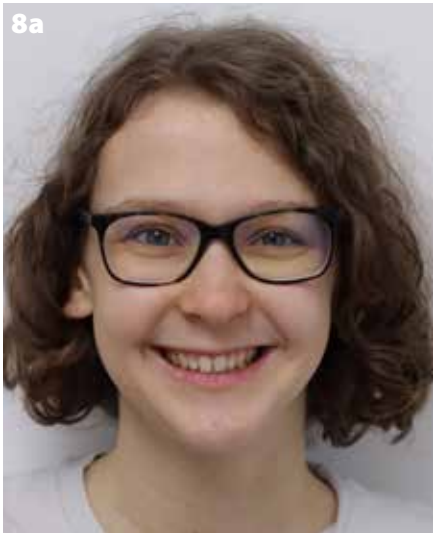

Fig. 15 a and b: Comparison before/after