The art of mimicking nature

Stefen Koubi[1] and Gérald Ubassy[2]

Attractive, flawless teeth have become a matter of course. Today's patients expect their teeth to be more than just functional. The appearance of teeth has become an integral component of well-being. As a result, modern dentistry no longer concentrates on simply providing curative and restorative treatment, but also offers esthetic dental solutions. Furthermore, the demand for minimally invasive treatment modalities is growing. As dental professionals, we have a responsibility to act according to ethical principles and to use the best possible treatment options. In some cases this means having to explore new possibilities and/or question customary procedures. For example, do severely stained teeth always have to be completely masked with an opaque material, or can we find a way of "covering up" the stain, but still maintaining the lifelike colour from within the tooth?

Case study

The idea behind the present case was to regard the stained tooth structure as a friend rather than a foe and to tackle the challenges playfully. Lithium disilicate in the form of the product IPS e.max® Press presented a welcome partner in this task. This material can be used to fabricate very thin veneers that are not much thicker than contact lenses, which are subsequently bonded to the teeth. The restorations impart the teeth with long-lasting, lifelike characteristics.

Analysis

The patient consulted us about a solution to cover up her severely stained teeth (upper and lower jaw) (Fig. 1). Since the treatment objective was of an esthetic nature, it was of utmost importance to adhere to the principles of minimally invasive dentistry. After the diagnosis had been made and discussed with the patient, the esthetic parameters were established. It is standard practice to document this type of case with photos taken when the jaw is at rest and in a dynamic position. The treatment plan was based on a

Figure 1: Preoperative view: The patient wished to have the stains on her teeth covered up. Treatment with pressed ceramic veneers was planned.

[1] *Dr Stefen Koubi, Marseille*
Contact details:
Dr Stefen Koubi, L'institut de la facette, 53 bis rue Saint Sebastien 13006 Marseille, France. koubi-dent@wanadoo.fr

[2] *Gérald Ubassy, Rochefort du Gard/France*
Contact details:
Centre de Formation International, Route de Tavel – Impasse des Ormeaux, 30650 Rochefort du Gard, France. contact@ubassy.com • www.ubassy.com

Figure 2: Minimally invasive preparation: Horizontal reference grooves were placed in order to define the penetration depth in the enamel.

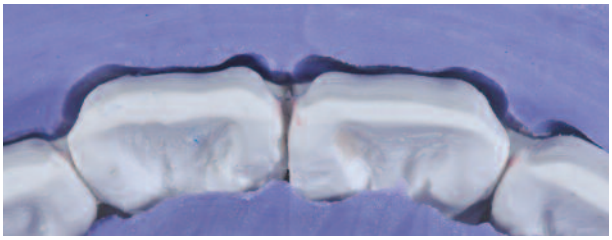


Figure 3: Silicone matrix, which was made from the wax-up, on the model. The challenge was to effectively hide the stains, while at the same time creating a natural-looking appearance using ultra-thin restorations.

diagnostic wax-up. Morphological criteria were of minor importance in this case, since the treatment focused on masking the stains. Only very small adjustments were made, for example, with regard to the position of tooth 12. In addition, the patient requested that the narrow diastema between tooth 11 and 21 be closed.

Planning

We pursue biomimetic principles whenever we can and aim to cause minimal harm to healthy tooth structure. Furthermore, we strive to include the natural 12 teeth in the treatment plan. Modern materials provide the equipment we need to meet this challenge. The properties of many all-ceramic products are almost identical to those of dental enamel. The materials even assume the colour of the natural tooth structure. With the appropriate techniques a natural appearance can be imparted to ultra-thin restorations. In the case at hand, we decided to make the most of the excellent light-optical properties of lithium disilicate. The low opacity of pressed ceramic, which is often considered to be a disadvantage for veneers, actually became our "friend" in this project. The conventional solution of choice would have been to treat the patient with highly opaque veneers fabricated on refractory dies (a rather complex procedure). Our approach, however, was to diffuse the stains rather than to completely mask them. The pressed lithium disilicate veneers would act like an optical filter. They would allow light to pass through but would scatter it, similarly to natural dental tissue.

Ingot selection

We were faced with the challenge of removing only a minimal amount of tooth structure and then masking the teeth and creating the illusion of natural enamel. We selected a suitable IPS e.max Press ingot before (!) we prepared the teeth, taking into account the light-optical potential of the material. In cases where stains have to be completely covered up, a highly opaque ingot should be used. A considerable amount of space, however, is required to imitate the interplay of the colours within this type of restoration. In the present case, therefore, we selected a press ingot showing low translucency (LT). We planned to characterize the framework with a subsequent layer. The decision to use a translucent ingot in order to treat discoloured dentition may seem rather unusual. Nevertheless, it was based on a careful analysis of the particular situation and the lightoptical properties of the material. The idea was to have the veneers act like optical filters that would change the colour of the dentin tissue. Nature provided the inspiration: Dental enamel is NOT transparent, but translucent. It scatters light and therefore modifies the colour of the tooth.

Preparation

A silicone matrix (wax-up) was used as a reference in tooth preparation. A small but adequate amount of tooth structure was removed in the visible esthetic part of the tooth. In order to define the preparation depth in the enamel, we placed horizontal reference grooves (groove grinder, ballshape) (Fig. 2).

Figure 4: The pressed frameworks (IPS e.max Press LT) were approximately 0.3 mm thick. We took advantage of the light-optical properties of the translucent ingots (Low Translucency).

Figure 5: The layers were built up on the framework (light-optical filter) with different ceramic materials (IPS e.max Ceram).

Figure 6 and 7: After polishing, the thin veneers showed natural-looking translucency combined with slight opalescence and a lively interplay of colours. The appearance of the surface is influenced by the irregularities in the texture.

Laboratory work

An optimum situation was established by means of the wax-up (Fig. 3). The ceramic restorations were produced in the next step. The ceramic veneers were fabricated according to the customary technique using IPS e.max Press LT ingots (Fig. 4). In the subsequent characterization procedure, the translucent properties of the framework structure were maintained and the brightness of the "teeth" was increased with a layering ceramic (IPS e.max Ceram). We strove to achieve a masking (saturated) effect by using bright and opaque Enamel materials. The greatest challenge in the layering process was to imitate the dentin structure, the absorption areas, the "opalescent" translucency and the "halo" effect in the incisal third of the teeth. When ultrathin restorations are being made, it is advisable to verify the shade achieved with IPS e.max Ceram Essence materials in the stains firing process.

The pressed frameworks were approximately 0.3 mm thick. The cervical areas and the middle third of the restorations were merely coated with a thin layer of Dentin material (Deep Dentin B1). In order to achieve an illusion of depth, we applied an Effect material (Opal Effect 1) to vertical segments of the proximal areas. We placed a translucent Dentin layer between the proximal areas – mixing ratio of 1:1 composed of unsaturated Dentin B1 and neutral Dentin. We selectively layered a mixture of Mamelon material (MM light and MM yellow-orange) in the upper third of the restoration. Below the mamelons, we placed what we refer to as an "absorption material": Opal Effect violet, a purple powder, was mixed and coloured with 50 per cent Impulse Transpa brown-grey. The difficult part of this procedure was to place the individual materials on the veneers without increasing their thickness. Finally, the layers were coated with an opalescent ceramic material (Opal Effect 4) to complete the esthetic effect. The successful outcome was dependent on the ratio in which the different materials were used: A third of the layer consisted of the mentioned materials and two thirds of the opalescent ceramic (Opal Effect 4) (Fig. 5).

The surface morphology was created according to models, which provided a reference for the tooth shape and texture. In the finishing step, we used our established "two-coloured pencil technique" to apply the ridges and concavities. Furthermore, we incorporated very fine, almost indiscernible structures. Subsequently, the restorations were mechanically polished to ensure their smooth integration in the mouth of the patient (Figs 6 and 7).

Cementation

It is of utmost importance for the longevity of ultra-thin restorations that they be placed with the adhesive luting technique. Nevertheless, this treatment step is a daunting procedure for many dental practitioners due to previous complications with this technique. However, if a strict procedure is followed, failures can be avoided.

Try-in

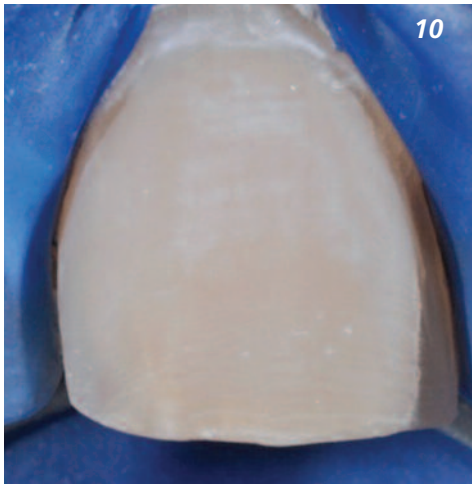
- Functional: Precision fit is essential! "Our" restorations fully met this prerequisite (IPS e.max has a precision of 50 micrometres, which is ideal).
- Esthetic: The shade of the restorations was simulated with glycerine-based try-in pastes and a suitable shade was selected for the luting composite (Variolink® Veneer) (Fig. 8).

Selection of the adhesive agent

Since the retention of veneers depends entirely on the strength of the bond to the tooth structure, adhesive systems that employ acid etching should be used. They provide excellent bonding results (ExciTE® DSC).

Figure 8: Before the veneers were placed, they were tried in with glycerine-based try-in pastes to simulate the outcome and to select the suitable luting composite shade (Variolink Veneer).

Figure 9: The shade of the prepared teeth was taken into consideration in the selection of the luting composite. The whitish Variolink Veneer High Value +2 paste was chosen. A highly translucent luting cement would have made the restorations look grey.



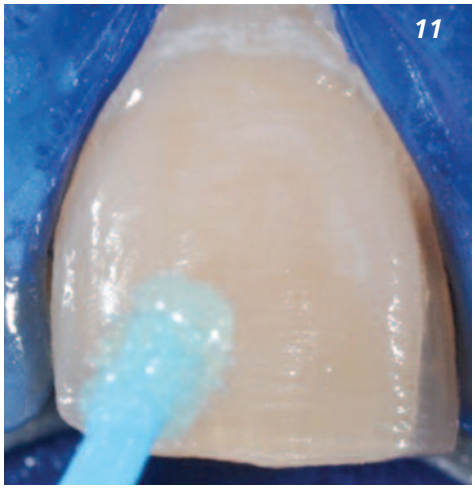


Figure 10 and 11: The veneers were cemented according to a sophisticated and systematic procedure.

Cementation material

Light-curing luting composites are preferred for the cementation of veneers due to their long-term esthetics and easy handling. In this case, a material was chosen which reinforced the desired light-optical qualities: the light Variolink Veneer Value +2 paste (Fig. 9). A highly translucent material would have given the veneers a greyish tinge.

Working field

We recommend the placement of a rubber dam around the individual teeth. Rubber dam isolation does not hamper the exact placement of the restorations and it has distinct benefits: The dental practitioner can concentrate on each tooth individually; the prepared tooth surfaces can be sandblasted without the patient inhaling any harmful aluminium oxide particles; and, excess composite can be removed with ease.

Figure 12 and 13: The seated restorations. The adhesive bond ensures longlasting adhesion of the veneers.

Figure 14: The thin veneers blend in smoothly with the orofacial environment. The result is not compromised by any stained areas. The fundamental principles of biomimetics have been fulfilled.

Bonding

The teeth were air-abraded to remove the bonding agent of the provisional restorations (Fig.10). Next, the teeth were etched with 37 per cent phosphoric acid. Then the primer and the bonding agent were applied within 40 seconds and the surface was dried (Fig.11). The materials were light-cured for one minute. The restorations were etched with hydrofluoric acid for 20 seconds. Next, they were carefully rinsed, conditioned with silane and coated with a light-curing bonding agent. Then the veneers were placed and excess cement was removed. Finally, the restorations were light-cured for 40 seconds at a high intensity (1200 mW/cm2; Bluephase® 20i).

Finishing of the restorations

The rubber dam was removed and the cervical areas were carefully finished. We used a no. 12 scalpel blade in order to prevent the risk of harming the ceramic surface. Finally, the static and dynamic occlusion was checked. The results were highly attractive. The stains were hidden, but the restorations had a lifelike shade, translucency and brightness. This combination of veneer, cementation material and tooth produced a highly resistant structure similar to that of natural dentition (Figs 12 and 13).

Conclusion

Attractive, flawless teeth have become a matter of course. In the described case, pressed lithium disilicate veneers offered an efficient means of achieving a natural balance between opacity (coverage) and translucency (vitality). The restored teeth exhibit a lifelike interplay of fluorescence and brightness (Fig. 14).

Reprinted with permission by Reflect 01/2014