Minimally invasive treatment of stained anterior teeth

The art of mimicking nature with the use of pressed ceramic veneers

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Today’s patients expect attractive, flawless teeth as a matter of course rather than merely functional teeth. The appearance of teeth has become an integral component of a person’s well-being. As a result, dentistry no longer is considered to be merely functional teeth. The appearance of teeth has become a matter of course rather than minimal harm to healthy tooth structure. We also try to consider the natural teeth in the treatment plan. Modern materials provide the tools we need to meet this challenge. The properties of many all-ceramic products are almost identical to those of dental enamel; the materials even mimic the colour of the natural tooth structure. With the appropriate techniques, a natural appearance can be imparted to ultrathin restorations.

The demand for minimally invasive treatment modalities is growing. As dental professionals, we have the responsibility to act according to ethical principles and to choose the best possible treatment options. In some cases, this means questioning entrenched habits and exploring new possibilities. Do severely stained teeth always have to be completely masked with an opaque material, for example, or can we find a way of covering up the stain, but still maintaining the lifelike colour from within the tooth?

The approach to the case presented here was to consider the stained tooth structure an ally rather than a foe. Lithium disilicate in the form of IPS e.max Press (Ivoclar Vivadent) was used, as the material can be used to fabricate very thin veneers that are not much thicker than contact lenses. Bonded to the teeth, it allows the creation of long-lasting restorations with lifelike characteristics.

A patient consulted our practice owing to her severely stained maxillary and mandibular teeth (Fig. 1). After the diagnosis had been discussed with the patient, aesthetic parameters were established. It is standard practice to document this type of case photographically with the jaws at rest and in a dynamic position. The treatment plan was based on a diagnostic wax-up. Morphological criteria were of minor importance, as the treatment focused on masking the stains. Only very small adjustments were made, for example, with regard to the position of tooth 12. The patient also requested that the narrow diastema between tooth 11 and tooth 21 be closed.

In this case, we decided to make the most out of the excellent optical properties of lithium disilicate. The low opacity of pressed ceramic, which is often considered to be a disadvantage for veneers, was actually useful as a very thin veneer could be placed on the tooth. The clinical outcome demonstrated the excellent aesthetic results that can be achieved with minimally invasive treatment modalities.

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The main challenge was to remove only minimal amount of tooth structure and then mask the teeth to create the illusion of natural enamel. We selected a suitable IPS e.max Press ingot before preparing the teeth, considering the optical potential of the material. In cases in which stains have to be completely covered up, a highly opaque ingot is recommended.

A considerable amount of space, however, is required to introduce interplay of colours in this type of restoration. Therefore, we selected a pressed ingot with low translucency (LT), which may seem unusual. The decision was based on a careful analysis of the particular situation and the optical properties of the material. The idea was to have the veneers act like optical filters that would change the colour of the dentine tissue. Dental enamel is not transparent but translucent; it scatters light and therefore modifies the colour of the tooth. We also planned to characterize the framework with a subsequent layer.

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 aesthetic part of the tooth. In order to define the preparation depth in the enamel, we placed horizontal reference grooves (ball-ended groove bar; Fig. 2). The optimum situation was established with the help of the wax-up (Fig. 3).

In the next step, the 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 layer of ceramic (IPS e.max Ceram, Ivoclar Vivadent). We aimed to achieve a masking (saturated) effect by using bright and opaque enamel materials. The greatest challenge in the layering process was to imitate the structure of the dentine, the absorption areas, the opalescent translucency and the halo effect in the incisal third of the teeth. When ultra-thin restorations are produced, 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 0.5 mm thick. The cervical areas and the middle third of the restorations were coated with only a thin layer of dentine 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 then layered a translucent dentine layer of unsaturated Dentin B1 and neutral Dentin in a ratio of 1:1 between the proximal areas. 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. We used Opal Effect violet, a purple powder, which was mixed and coloured with 50% Impulse Transpa brown-grey. The difficult part of this procedure was placing the individual materials on the veneers without increasing their thickness. Finally, the layers were coated with an opalescent ceramic material (Opal Effect 4) to achieve the desired aesthetic effect. A successful outcome depended on the ratio in which the different materials were used. The layers consisted of a third of the above-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 for applying the ridges and concavities. In addition, we incorporated very fine, almost indiscernible structures. The restorations were then mechanically polished to ensure their smooth integration in the patient’s mouth (Figs. 6 & 7).

For improved longevity, ultra-thin restorations have to be placed with the adhesive luting technique. This treatment step is a daunting procedure owing to previous complications with this technique. Failures can be avoided, however, if the procedures are followed strictly.

Our restorations fully met the prerequisite of a precision fit (IPS e.max has a precision of 50 µm, which is ideal). The shade of the restorations was simulated with glycerine-based try-in pastes and a suitable shade was selected for the luting composite (Vitrolink Veneer, Ivoclar Vivadent; Fig. 8). 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, as they provide excellent bonding results (Excite F DSC, Ivoclar Vivadent).

Light-curing luting composites are the preferred choice for the cementation of veneers owing to their easy handling and long-lasting aesthetics. The material, Variolink Veneer High Value “+2 paste, selected in this case reinforced the desired optical qualities (Fig. 9). A highly translucent material would have given the veneers a greyish tinge.

We recommend placing a rubber dam around each tooth. This isolation has distinct benefits: the dental practitioner can concentrate on each tooth individually, the prepared tooth surfaces can be air abraded without exposing the patient to any harmful aluminium oxide particles, and excess composite can be easily removed. Isolating the teeth with a rubber dam does not hamper the exact placement of the restorations.

The teeth were air abraded to remove the bonding agent used for the provisional restorations (Fig. 10). The teeth were then etched with 37% phosphoric acid. The primer and the bonding agent were applied within 40 seconds and the surface was dried (Fig. 11). The materials were light cured for 1 minute. The restorations were etched with hydrofluoric acid for 20 seconds. They were also carefully rinsed, conditioned with silane and coated with a light-curing bonding agent. The veneers were placed, excess cement was removed and the restorations were light cured for 40 seconds at a high intensity (1,200 mW/cm²; Bluephase 20i, Ivoclar Vivadent). Finally, the rubber dam was removed and the cervical areas were carefully finished. We used a #12 scalpel blade to prevent harm to the ceramic surface. Finally, the static and dynamic occlusion was checked.

The results were highly attractive. The stains had been hidden, but the restorations had a life-like shade, translucency and brightness. This combination of veneer, cementation material and tooth produced a highly resistive structure similar to that of natural dentition (Figs. 12 & 13). In this case, pressed lithium disilicate veneers offered an efficient means of achieving a natural balance between opacity (coverage) and translucency (vitality). The restored teeth exhibited a life-like interplay of fluorescence and brightness (Figs. 14)....