From digital planning to the mock-up and final restoration

Presentation of a modern work concept on the basis of a veneer fabrication

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Introduction

The demand for cosmetic treatments is also increasing in dental practices. The Internet provides patients with virtually limitless access to a wealth of information on this topic. And with it comes an increase in expectations. This can pose a conundrum to the dentist: patients want to be promised the desired results, yet, they should not be given undue expectations in the run-up to the treatment.

The challenge

One of the challenges in day-to-day dentistry is the fact that the mock-up presented to the patient is produced from a wax-up, and is often not consistent with the final outcome of the treatment (e.g. ceramic veneers). Several research studies have been initiated to overcome this problem. The SKYN concept is a result of this research.

The solution

The SKYN concept is based on a unique approach: it uses natural tooth shapes to create a mock-up directly in the patient’s mouth. A wax-up is created on the basis of tooth shapes that reflect the anatomy and morphology of natural teeth in terms of height, width, curvature and surface texture. The predictability of the result is ensured by using CAD/CAM technology to scan the mock-up, make adjustments in the oral cavity, and then mill the veneers to achieve lifelike results. The reproducibility of the mock-up and the accuracy of the result arise from, among others, the performance of the CAD/CAM system, allowing the expectations of the patient to be met both promptly and effectively.

CAD/CAM technologies have brought about a revolution in dentistry. They enable the efficient manufacture of customised ceramic veneers with high accuracy and within a short period of time.

Figs. 1a & b: Initial situation. Severely stained restorations in the upper anterior region (a). It does not bother the patient that her upper lip is asymmetrical and her gum line is visible when she laughs (b).
Furthermore, the restorations present an accurate copy of the aesthetic wax-up. The different working steps involved in the SKYN concept are demonstrated in the following clinical case.

Case report

Initial situation

The patient visited the practice with a request that mainly concerned aesthetic criteria. She felt that her anterior restorations looked too yellowish and their shape did not fit in. The restorations had been in her mouth for several years and the patient wanted to change them.

First, a series of digital pictures was taken to examine the situation more closely. The patient had a high smile line. However, the fact that her gums were visible when she smiled and her upper lip was asymmetrical did not bother her (Figs. 1a & b). The periodontal apparatus was healthy. The soft tissues did not show any signs of abnormalities either.

Treatment planning

We recommended the patient to have the anterior region restored with veneers stretching from teeth 15 to 25, and advised her to have the premolars included in the restoration to achieve a harmonious appearance. The patient agreed with our proposal. We drew up the following treatment plan:

- Wax-up using composite veneers to reproduce the natural shape and texture of the teeth.
- Mock-up according to the SKYN concept using a light-curing nanohybrid composite (IPS Empress Direct).
- Intraoral digital data scan of the mock-up.
- Preparation of the teeth with the help of the mock-up.
- Digital impression of the preparation using an optical camera.
- Fabrication of the temporaries.
- Machining of the glass-ceramic veneers (IPS Empress CAD).
- Incorporation of the veneers.

Fabricating the wax-up

The aim of the ceramic veneers was to give more volume to the teeth. The teeth should appear stronger and longer. Adjusting the dental proportions was requisite to creating a harmonious appearance between the teeth and the smile on the patient’s face. To create the wax-up, we used the SKYN models (“Anterior Model Set” by Dr Jan Hajtó) as reference (Fig. 2). This is a reproduction of natural teeth. Upon request by the patient, tooth selection was performed with the help of both the Digital Smile Design programme and the VisagiSMile design and visualisation software.

Fig. 2: SKYN models (according to Dr Jan Hajtó) for the fabrication of the wax-up. Fig. 3: The composite (IPS Empress Direct) is applied into the silicone key. Figs. 4a & b: The composite veneers created with the help of the silicone key show a natural shape and surface texture on the model. Tooth 11 (a). Teeth 15 to 25 (b). Fig. 5: The mock-up is placed in the mouth. The surfaces are being reworked slightly. Fig. 6: Completed mock-up. Photos and videos are used to assess it. Figs. 7a & b: The surfaces of the mock-up are being reworked slightly. Side view (a). Front view (b). Fig. 8: Targeted preparation of the teeth with the mock-up in place. Fig. 9: Close-up of the prepared anterior teeth.
Transfer to the mock-up

We created a silicone key of the vestibular surfaces with the help of the wax-up and applied a thin layer of composite material into the key using a spatula (IPS Empress Direct; Fig. 3). Once light-cured (Bluephase with Polywave LED), the resulting composite veneers for teeth 15 to 25 were placed on the model and stabilised with wax (Figs. 4a & b). Once the wax-up was finalised, it was duplicated and cast in stone. We created a silicone key from this model to assist the dentist in the preparation of the teeth. The silicone key was created in two steps using two different silicone materials, one with a high hardness (Silico Dur, Cendres+Métaux) and the other with a low hardness (3M ESPE Express). The silicone key served to create the mock-up and the temporaries.

Tooth preparation and data transfer to the lab

The mock-up was inserted with the help of the silicone key and the surface texture was reworked using a polishing system (Astropol; Fig. 5). The aesthetic effect was validated with photographs and videos. The patient could also inspect the pictures (Figs. 6 & 7). Then, the teeth were prepared using a ball-shaped bur whilst the mock-up was in place (Galip Gürel 2003) (Fig. 8). This procedure meets the requirements of minimally invasive dentistry. An impression of the prepared teeth (Fig. 9) was taken using an intraoral scanner and the temporaries were fabricated with the help of the silicone key.

At this point, the dentist is required to take two optical impressions: first, an impression of the prepared teeth and, second, an impression of the temporaries in the mouth. In addition, a conventional silicone impression of the prepared teeth is taken. The dental technician will use this impression to produce a physical model to check the fit and contact points of the milled ceramic veneers.

Creating the final restoration

For the CAD construction, the two data sets (temporaries, prepared teeth) were superimposed in the software (Fig. 10). Subsequently, the shape of the temporaries was matched to the preparation margins. Each component was examined (preparation margin, thickness, contact points, etc.) separately before the data was transmitted to the milling unit for machining (Fig. 11). For the fabrication of the veneers, we decided to use the IPS Empress CAD Multi blocks, which feature a lifelike shade transition from the dentine to the incisal. We selected a block in shade A1. Each veneer was positioned in the block in such a way that the translucency of the incisal area matched our requirement. Once the veneers were milled, we checked their fit on the prepared dies of the model and assessed their contact points with each other. The surface texture was lightly reworked (Fig. 12). To achieve a highly aesthetic result, we additionally characterised the veneers with Stains and Essence materials (IPS Ivocolor) before we glaze-fired them (Fig. 11).
Seating the ceramic veneers

At the try-in, the shade and fit were checked. All ten veneers showed an excellent fit in the mouth. The next step was adhesive bonding. Prior to the bonding procedure, a rubber dam was placed to isolate the treatment field and to keep it dry. As the natural teeth were not discoloured, we were able to use a translucent luting composite (Variolink Esthetic) to insert the veneers (Fig. 13). The veneers were seated using the following protocol:

- The restorations were etched with hydrofluoric acid for 60 seconds, rinsed under running water and dried with compressed air.
- The veneers were then conditioned with silane. A universal primer (Monobond Plus) was applied, allowed to react for 60 seconds and dried.
- The prepared teeth were etched with 37% phosphoric acid gel (Total Etch) and rinsed.
- Fluoride-releasing Excite F DSC adhesive was applied (without light-curing).
- The veneers, which were coated with luting composite, were seated.
- The luting composite was tack-cured for 1 to 2 seconds (Bluephase with Polywave LED) to facilitate the clean-up of excess luting composite.
- Final light-curing of all veneers for 40 seconds.
- Removal of the rubber dam and occlusal check. At the last step, the restorations were polished.
- The ceramic restorations show an appealing aesthetic appearance in the mouth and harmonize beautifully with the smile of the young patient. The planned situation was accurately transferred to the final restoration (Figs. 14–16).

Conclusion

Modern materials in aesthetic dentistry allow pleasing results to be achieved with considerably more ease than before. It may be considered a substantial progress that the resulting restorations meet not only high aesthetic requirements, but also essential functional criteria. State-of-the-art planning tools, digital auxiliaries, CAD/CAM-supported manufacturing and promising materials lead to excellent results and ensure high patient satisfaction. However, regardless of the relatively new CAD/CAM technologies, the skills and experience of a seasoned dental technician will remain indispensable.

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