Direct veneers in anterior smile design

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This clinical case report describes in detail the application of Tetric N-Collection to reconstruct the patient's smile chairside in the least invasive manner.

Direct additive procedures with bonded resin composites are considered the most conservative and least invasive technique[1] to return missing, diseased and unsightly tooth structure to enhanced colour, form and function in the esthetic zone However, the creation of natural-looking restorations can be quite a challenge for the clinician. For complex anterior composite restorations the clinician must have a comprehensive understanding of the colour, translucency and morphology of natural teeth as well as of the materials science[2,3] and the restorative techniques involved.[4,5] Today's nano-hybrid composites provide improved strength, wear resistance, handling properties and surface characteristics.[6]

The question is, however, if their optical properties can ideally mimic natural tooth tissues – a prerequisite for restorations that are invisible to the human eye at a speaking distance.

Case presentation

A 29-year-old male patient presented to the dental practice with the request to have the esthetic appearance of his smile improved. The clinical examination revealed that teeth 13, 12, 11, 21, 22 and 23 were affected by multiple carious lesions, various discoloured composite restorations and slight erosions. In addition, the incisal edges of teeth 12, 11 and 21 were abraded and too short. The tooth proportions were not harmonious: Teeth 11/21 were too wide in relation to 12/22 (Fig. 1). It was the patient's primary goal to get rid of the discoloured restorations, to lengthen the front teeth and to regain a harmonious appearance in terms of shape and colour. In addition, the patient explicitly wished the treatment to be carried out with minimal loss of tooth structure and financial cost.

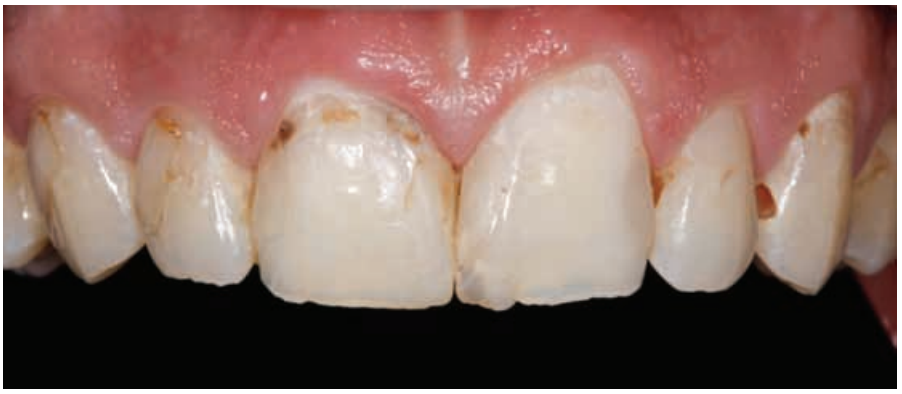

Figure 1: Initial situation: Unsatisfactory smile with multiple carious lesions, discoloured composite restorations and abraded areas.

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Figure 2: Wax-up of the new smile on the plaster model with silicone key in position.

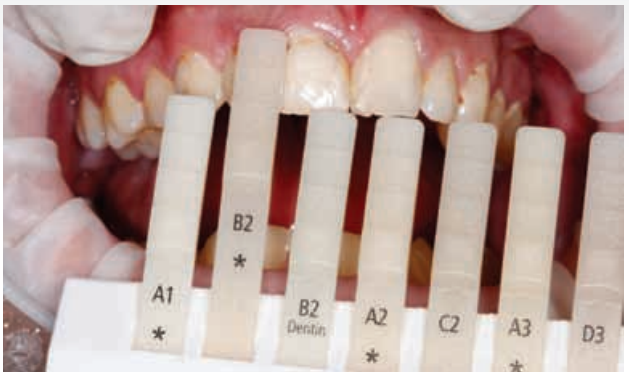

Figure 3: Shade selection with Tetric N shade guide; lips and cheeks retracted with OptraGate.

Figure 4: Distal aspects of both central incisors prepared with a diamond-coated wheel.

Figure 5: Additional space gained for the lateral incisors to correct tooth proportions.

Preparations for the chairside treatment

Vinyl polysiloxane double-mix impressions (Virtual® Light Body & Putty) of the patient's existing dentition were made and plaster models created. First, the tooth proportions were corrected by preparing the distal aspects of both central incisors on the plaster model. Then all anterior teeth from canine to contralateral canine were waxed up by the author in the lab in order to design the new smile: The correct length and position of the incisal edges and ideal tooth contours were created. This wax-up was captured in a silicone key (Virtual Putty) that would serve as a chairside template for the subsequent anatomically layered composite build-ups (Fig. 2).

Chairside treatment

In order to gain good access to the treatment field, the patient's lips and cheeks were retracted using an OptraGate® lip and cheek retractor. This device is comfortable to wear over longer periods of time, as it is three-dimensionally flexible. Prior to any tooth preparation the shade was determined using the Tetric® N shade guide (Fig. 3). The selected tooth shade (B2) was then confirmed by applying and light-curing a small composite sample of Tetric N-Ceram (B2) to the central incisor without any bonding procedure. To correct the tooth proportions, the distal aspects of both central incisors were carefully prepared with a diamond-coated wheel at slow speed, without water cooling (Fig. 4). The additional space gained with this preparation procedure allowed the dimensions of the lateral incisors to be changed with additive procedures. Their width needed to be increased by building up the mesial aspects with composite to correct the overall tooth proportions according to the Golden Proportion (Fig. 5). After removing all the defective composite restorations and decayed tooth tissue, large defects and multiple diastemata were visible. In order to achieve a seamless integration of the composite build-ups, minimally invasive veneer preparations with a supra-gingival chamfer design were performed with a round-ended tapered diamond bur (Figs 6 and 7).

Figure 6: Minimally invasive veneer preparation with a round-ended tapered diamond bur…

Figure 7: …results in a supra-gingival chamfer preparation design.
Figure 8: Differential etching of enamel and dentin surfaces with 35% phosphoric acid gel.

Bonding procedure

An etch-and-rinse protocol was selected as the standard bonding procedure for the direct veneers. After differential etching of enamel for 30s and dentin surfaces for 10s with 35% phosphoric acid gel (Fig. 8), the teeth were rinsed with copious amounts of water and briefly air dried in order to keep the dentin surfaces slightly moist. Tetric N-Bond was selected as the light-curing bonding agent. It was directly dispensed from the VivaPen® in an economical and targeted way: By activating the click mechanism several times, the attached VivaPen brush cannula was wetted with Tetric N-Bond (Fig. 9). All the etched tooth surfaces were coated with a thick layer of bonding agent, which was scrubbed in for at least 10s. Excess bonding material was removed with the saliva ejector, and the solvent (ethanol) was evaporated by a gentle stream of air. Next, the bonding layer was light-cured for 10s using a polywave LED curing light with an energy density of 1,200mW/cm2 (e.g. Bluephase® N). The resulting shiny appearance indicated that all tooth surfaces were entirely bonded and ready to be restored. The lab-fabricated silicone key was applied on the palatal-incisal aspects of the patient's upper anterior teeth and checked for fit. A significant discrepancy between the remaining healthy tooth structure and the projected outline of the teeth was obvious with the silicone key in place (Fig. 10).

Composite stratification

The overall goal was to rejuvenate the patient's smile not only in terms of tooth contours but also in terms of a natural colour gradient and different translucency levels. The incisal edges of younger, non-abraded teeth often show a high level of opalescence. The aim in this clinical situation was to reproduce this effect.

The cornerstone to achieving an esthetic outcome is to create the colour within the dentin core and to stratify enamel layers of different translucencies and opalescence to mimic the natural beauty of teeth.

Hence, a translucent flowable composite (Tetric N-Flow,

Figure 9: Precise and economical application of Tetric N-Bond directly from the VivaPen.

Figure 10: Lab-fabricated silicone key applied and checked for fit.

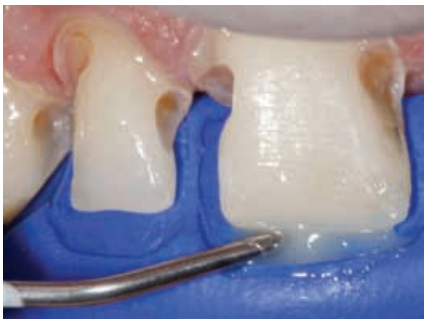

Figure 11: Application of a translucent flowable composite – spread to a thin layer.

Figure 12: Thin translucent and opalescent "enamel shells" with the characteristic "halo effect".

Figure 13: Application of an opaque dentin composite material with high chroma.

Figure 14: Application of a darker opaque flowable dentin material in the cervical area to create a colour gradient.

shade Bleach I) was applied with the silicone key in place. It was spread to a thin layer with a dental probe (Fig. 11) and light-cured for 10 s. The Bleach I shade shows a much higher degree of translucency (20%) compared with standard enamel shades (13-15%) and allows the light to pass through the composite. These thin "enamel shells" are highly opalescent and show the characteristic "halo effect" around the incisal edges (Fig. 12). Next, the existing dentin defects and the dentin cores were built up anatomically (Fig. 13) with an opaque, highly chromatic composite material (Tetric N-Ceram, Dentin shade B2). It was of utmost importance to impart all the restorations with sufficient chroma through an adequate thickness of the dentin core. Thus, the colour was developed within the depth of the restoration – avoiding a greyish appearance of the restoration. Nonetheless, enough space was kept for the subsequent enamel composite stratification.

In order to create a natural colour gradient a small amount of a darker opaque flowable dentin material with a high chroma (Tetric N-Flow, Dentin shade A 3.5) was applied on the cervical aspects of the teeth (Fig. 14). To further enhance the opalescence of teeth 12, 11, 21 and 22, additional opalescent composite (Tetric N-Ceram, shade Bleach I) was applied on the incisal third of the central and lateral incisors in thin layers. By applying miniscule scattered amounts of a light-curing white stain (Tetric Color White), the illusion of discreet whitish opaque areas of hypoplastic enamel was created within the incisal edge. A medium translucent enamel shade (Tetric N-Ceram, shade B2) was applied to build up all the teeth to full contour with natural emergence profiles. To conclude the composite stratification, proximal vertical ridges and embrasures were shaped (Fig. 15) with a non-sticky disposable "chisel" tip (OptraSculpt®). Tetric N-Ceram showed excellent sculptability and stability after application prior to light polymerization.

Finishing and polishing

For natural light reflections, the anatomically layered surface was refined using a fine-grit diamond finishing bur at low speed and without water spray. This enabled perfect visual control and reduced the risk of excessive removal of composite material. To create a homogeneous and smooth surface, another dry finishing step was carried out with an abrasive, silicon carbide-containing rubber polisher (Astropol® F) at slow speed. At this stage a silky surface lustre started to emerge. Anatomical surface characteristics such

Figure 15: Shaping the proximal vertical ridges and embrasures with a "chisel" tip/OptraSculpt.

Figure 16: Glossy surface lustre after wet polishing at high speed with Astropol HP.

Figure 17: The patient's rejuvenated smile after two weeks.

Figure 18: Close-up after two weeks: Pronounced opalescence, characterizations and halo effect.

Figure 19: Lateral view displaying composite surface characteristics with natural light reflections.

as vertical grooves can be further enhanced under good visual control. Subsequently, all composite surfaces were wet polished at high speed (Fig. 16) to achieve a glossy surface lustre (Astropol HP). Generally, for finishing and polishing esthetic anterior composite restorations best results are achieved with multi-step polishing systems.

Results

The patient was recalled two weeks after the treatment. With the tooth proportions and shapes corrected the patient's smile was now in harmony with the lips and the face (Fig. 17). A close-up of the patient's smile revealed a pronounced life-like opalescence, characterizations and halo effect of the central and lateral incisors (Fig. 18). The lateral view displayed natural light reflections from the highly polished macro- and micro-anatomically shaped composite surfaces (Fig. 19).

Discussion

As an alternative to the treatment described above, all-ceramic veneers (e.g. IPS e.max®) would have been a viable esthetic and durable treatment option – preferable to all-ceramic crowns because of their less invasive nature. However, the costs of all-ceramic restorations are substantially higher than any kind of direct resin restorations. Since the patient expressed serious financial concerns, the costly treatment option with ceramic veneers was not pursued. In this clinical case direct adhesive composite restorations were the preferred cost-effective treatment option. They also represented a very conservative treatment modality because any tooth preparations were strictly defect oriented and did not serve the purpose of generating retentive surfaces. Moreover, in the event of future fractures or chipping, composite veneers can be repaired much more easily and predictably than ceramic veneers – an advantage for cost-conscious patients.

Conclusion

The selection of a suitable composite material with optical properties that can ideally mimic natural tooth tissues is a major factor in creating restorations that blend in well with the remaining tooth structure and are invisible to the human eye. In the clinical case described above, the universal composite system Tetric N-Collection was utilized for the build-up of the patient's front teeth. The combination of opaque dentin shades with high chroma, medium-translucent enamel shades and highly translucent enamel shades with natural opalescence yielded a predictable and esthetic outcome in terms of colour saturation, translucency and opalescence.

In addition, the material features finely tuned filler technology which imparts favourable polishing properties that result in a high surface gloss. Tetric N-Collection has proved to be a universal composite system with a great esthetic potential and is, therefore, also suitable for esthetically challenging cases in the anterior dentition.

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