EXPERIENCE REPORT

Maximum efficiency with the aid of the injection technique

Application of Signum composite from Kulzer

BJÖRN MAIER

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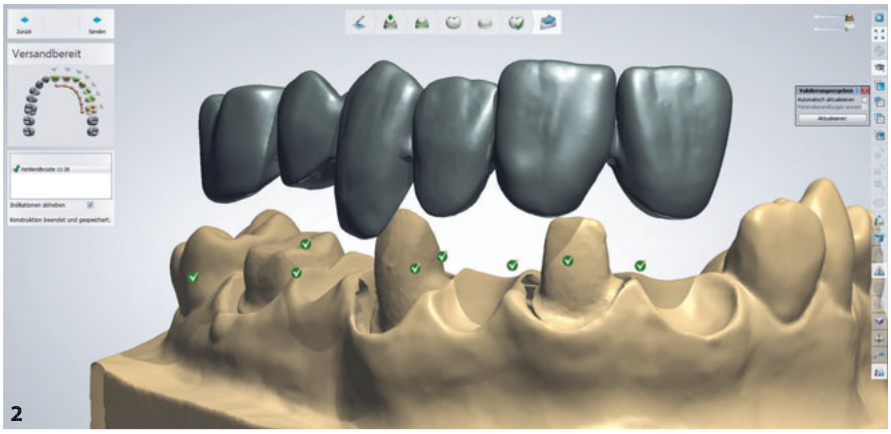

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Fig. 1 A combination of analogue and digital stages helps to facilitate the daily routine in the laboratory. **Fig. 2** A mock-up can be created in very little time using CAD.

Abstract
The processing technique described in this article demonstrates how highly efficient processing options in combination with digitally supported production chains are produced thanks to new material components, such as Signum flow composites and Signum cre-active stains (Kulzer, Hanau, Germany). Digitisation of dental technology processes does not replace fabrication of customised, situation-specific veneers but can greatly facilitate their implementation without losing customisation of the veneer, thanks to digital design and construction.

Indices
Additive fabrication, injection technique, 3D staining, stains, viscosity

Introduction

Thanks to their physical characteristics Signum composite veneers can be used for a wide range of applications. Their elasticity makes them suitable for customised veneering of hybrid restorations. As they also demonstrate adaptive wear characteristics, they are also suitable for use with fixed implant restorations to absorb masticatory loading and protect the implant as well as temporomandibular joint. In a documented presentation this article is intended to demonstrate how simply analogue and digital stages can be combined, helping to make the daily routine in the dental laboratory easier (Fig. 1).

Regardless of the area of application selected, a high-quality, custom-veneered restoration should always begin with a mock-up design. This procedure has become considerably easier in recent years, as digital options have evolved.

Planning and communication

Fabrication of a mock-up can be used to discuss the planned objective of treatment in detail with the patient and to plan the further procedure.

Whereas a few years ago a great deal of time had to be invested in an analogue wax-up or set-up with denture teeth for fabricating a mock-up, nowadays the computer calculates in a few steps the possible morphology, tooth position and dimensions of the restoration (Fig. 2). This type of data record can be modified at any time for further fine adjustments and the results can be printed at low cost (Fig. 3).

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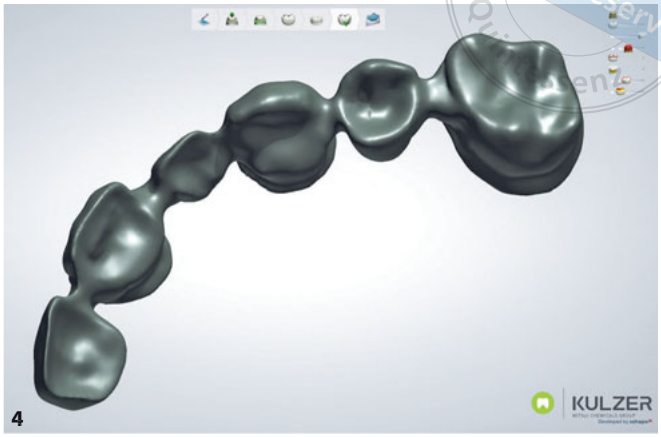

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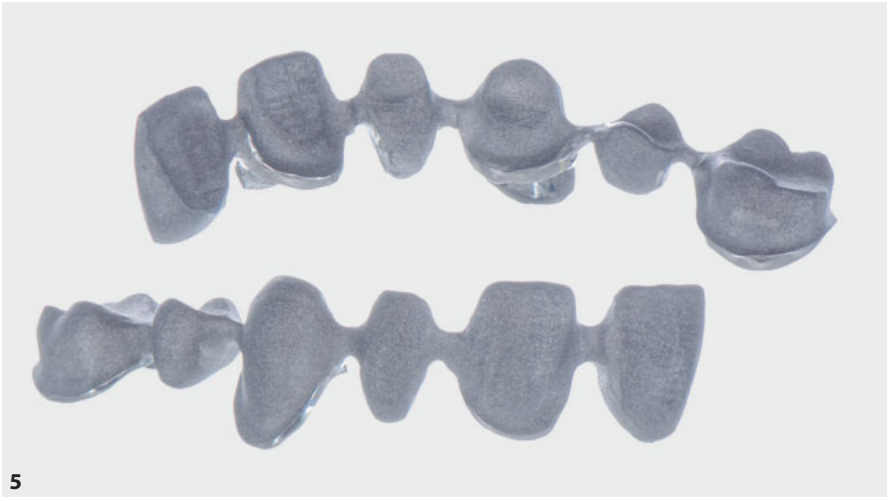

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Fig. 3 Using 3D technology the data record is printed from high-precision dima Print Stone gray resin. **Fig. 4** A single press of the button in the CAD programme is all that is required to reduce the framework structure. **Fig. 5** The framework construction can be fabricated using the additive or subtractive technique.

Following analogue adjustment of the morphological and functional objective, the data record is calculated back in the individual required construction units (Fig. 4). These are subtractively or additively fabricated from the selected materials (Fig. 5).

It's the result that counts

If all construction units are available for the planned restoration concept, it is then a matter of completing the dental restoration aesthetically and functionally. This final stage decides the result of the entire restoration and the demands thereon are correspondingly high.

In addition to morphology, angle characteristics and function, the individual shade and light-optical properties must be time-consumingly modelled using the appropriate shade modifiers. This requires the user to be very experienced and proficient. This procedure can be greatly simplified with the aid of Signum veneering composites Kulzer (Hanau, Germany), without having to sacrifice the high quality of the final result.

Indexing

Based on the digitally fabricated mock-up, the dimensions and function of the planned restoration are already available. It only remains to produce the age-appropriate light-optical effects. In addition to paste veneering composites, the Signum composite assortment also has flowable (thixotropic) composites. Veneers can be fabricated with these composites using the injection technique to save time. The following applies: the bigger the restoration, the greater the saving in time.

The mock-up is encased in translucent silicone for the injection technique. To avoid damaging the working model it is recommended to index the 3D printed aid independently of the working model.

This approach also has the advantage that no primary units are involved during implementation with telescope restorations. The stabilising base is fabricated using silicone (Pala Lab Putty, Kulzer) (Fig. 6). The inner geometry of the crowns is captured cleanly to fix the framework in position.

The actual indexing for transposing the composite veneers is fabricated using translucent silicone (Memosil, Kulzer). This is a two-component material that can be directly applied to the required areas using a dispenser and is fully polymerised within approximately two minutes (Fig. 7). Thanks to the high shore hardness of Memosil there is no longer the need for material-intensive flasking, as required with some other providers. It is sufficient to fabricate an approximately one centimetre thick overcast (Fig. 8).

Conditioning the framework

The framework, which has been sandblasted with 2 bar and 110 µm AlO2, is prepared in the conventional way for veneering. The newly developed Signum universal bond includes a bonder material that can be used in parallel for PMMA, PEEK, zirconia, metal etc. (Fig. 9).

Opaque is also applied to the framework using the conventional technique and then the framework is positioned on the silicone base (Fig. 10). A 1.1 millimetre (diameter of the tip) access is prepared in the mesial and distal regions of the Memosil overcast. To avoid flash formation this opening should always be prepared from the inside of the overcast towards the outer surface. The overcast is then fixed in position using super glue.

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Fig. 6 The mock-up for providing the form. **Fig. 7** The veneering area is encased using translucent Memosil. **Fig. 8** Thanks to the Shore hardness a casing of approximately one centimetre thick is sufficient. **Fig. 9** The newly developed Signum universal bond provides users with a bonding system suitable for virtually all framework materials.

Injection of the composite

Now a cannula is attached to the Signum flow dentine cartridge, which has been heated to 70°C, then placed on the drilled access and the material injected (Fig. 11). Once the cavity has been completely filled, it is recommended to cap the flow using a finger and press further material into the mould. This compresses the injected flow dentine, thus preventing the material from becoming inhomogeneous.

The author developed the device shown in Fig. 12 for heating the composite. Heating makes the paste and flow composites more homogeneous, softer and less viscous. Heating the flow composites in the injection technique is particularly effective with large restorations and thin tapering margins. A more detailed description of the use of the composite heaters can be viewed in the video under the QR code at the end of the article.

The composite restoration is now fully cured in the HiLite power for 180 seconds and then removed from the mould (Fig. 13).

Incisal brightness gradient

The enamel section of the veneer is reduced, as seen in Figure 14. To obtain a natural-looking enamel section it is recommended to ensure a varying dentine-enamel volume during reduction. This accentuates the mamelon structures, without having to characterise them using shade modifiers or stains. The dentine core is reduced according to the adaptation of denture teeth, natural teeth or ceramic veneers involved.

In the present case the restoration should be matched to Kulzer Premium anterior denture teeth in shade A3. These high-quality denture teeth have very natural-looking mamelon structuring, which is achieved by precise reduction as shown in Figure 14. The reduced surfaces are wetted using Signum liquid for


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Fig. 10 The prepared veneer framework is fitted on the silicone base. **Fig. 11** Flow dentine heated to 70°C is injected. **Fig. 12** The composite heater. **Fig. 13** The fully polymerised dentine pressing.

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restoring the dispersion layer, which is required to ensure a reliable bond (Fig. 15).

Signum cre-active stains, a 3D staining system

The reduced dentine can be individually characterised as required with the aid of Signum cre-active colours (Fig. 16). The viscosity of the colours can be individually adjusted as required using the two transparent materials (Signum cre-active T1 and T2). This is a decisive advantage compared with other systems, because adjustment of the viscosity allows the option of whether a stain should be applied extensively or selectively three-dimensionally (Fig. 17).

Composite veneering quite often involves matching shades to denture teeth, ceramic veneers or natural teeth. Regardless of how customised the individual denture teeth providers are, the shade interpretation of Vita classic basic shades are just as customised. The decisive factor is a simple alignment to the required reference body. The stains are adjusted accordingly to low viscosity using Signum T2 and applied with a wide brush to increase the chroma value (Fig. 18). Characteristics such as calcified cusp tips of posterior teeth can be achieved by adjusting the stains to high viscosity using Signum T1 (Fig. 19).

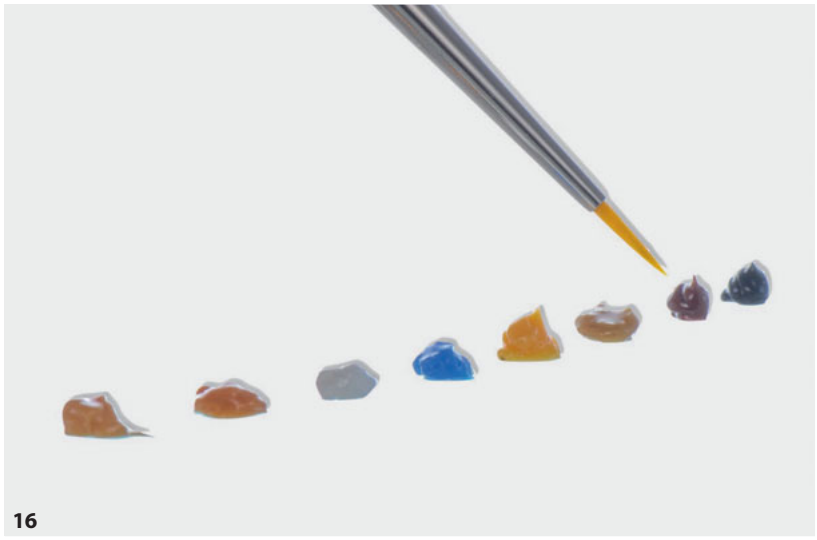

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Fig. 14 The enamel is reduced according to the required reference shade or teeth.
Fig. 15 The reduced surface is activated with Signum liquid and further processed.
Fig. 16 The Signum cre-active stains provide users with a 3D characterisation system.
Fig. 17 Thanks to the cre-active transparent materials T1 and T2 the required viscosity can be individually adjusted.

The stains are initially cured using the HiLite pre2 to fix them in position.

Incisal pressing

Following final characterisation with the stains, the restoration is fitted on its index again and the overcast placed on once more and fixed in position using a drop of super glue. The opal incisal heated to 70°C is injected in the same way as the dentine and fully polymerised for 180 seconds in the HiLite power (Fig. 20).

Finishing

The veneers can now be trimmed and refined using cross-cut rotary instruments. The age-appropriate surface structures are incorporated and the surface can be polished to reflect the degree of abrasion.

Instead of polishing, the Signum system has the option of glazing. To glaze, the opal incisal is wetted with a drop of Signum liquid and massaged onto the prepared surface (Fig. 21). The evenly distributed glaze-like coverage is initially cured for 90 seconds using the HiLite power. The entire surface of the veneer is then covered with Signum insulating gel and cured for a further 90 seconds (Fig. 22). Covering with Signum insulating gel prevents a reaction with oxygen during final curing and once the gel has been wiped off it leaves a glazed, finished surface (Fig. 23 to 25).

The insulating gel can be replaced in the appropriate container and is available for further use.

Limitless customisation

The implementation described up to now demonstrates an option necessary in many cases to achieve the majority of effects by means of targeted volume shaping in the interplay between dentine and enamel. Thanks to the 3D staining properties of Signum stains it is also considerably easier to respond more individually to age-specific characteristics such as opalescence, transparency, translucency, mamelon structures, sclerotic dentine etc.


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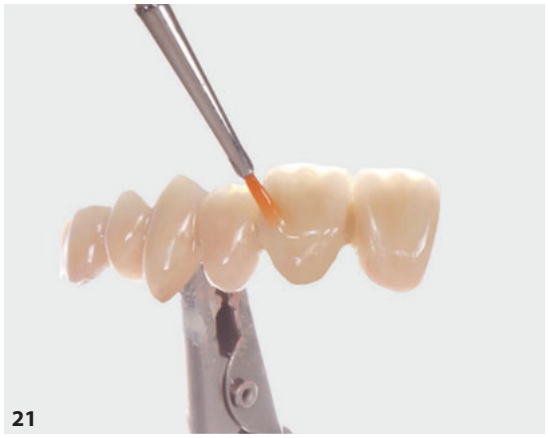
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Fig. 18 Signum cre-active stain, adjusted to a low viscosity, is applied using a wide brush for extensive shade reproduction. **Fig. 19** Selective characterisation is performed by adjusting Signum cre-active stains to have a high viscosity. **Fig. 20** The enamel section is pressed on using opal incisal in the same way as the dentine. **Fig. 21** Surface is sealed by massaging on a low viscosity enamel or transparent gel.

Individual adjustment of the viscosity using the transparent materials T1 and T2 allows the stains to be applied three dimensionally, particularly in the anterior region. This produces an additional depth effect that could not be achieved by purely painting stains on. By saturating the stains the effect, which is otherwise created from the depths of the tooth, can be achieved using much less volume than it would be the case with standard shade modifiers (Fig. 26 and 27).

To complete the restoration the structures are again overpressed with opal incisal, which has been heated to 70°C (Fig. 28). Thanks to the transparent properties of the opal incisal the dentine core pressing, which has been reduced to the cervical region, can be thinly covered without lightening the basic shade.

Even if the enamel pressing is more voluminous the opalescent structures stabilise the enamel. There is no greying of the transparent sections, as is very familiar from other veneering systems.

Fig. 22 To avoid a dispersion layer the surface is covered with Signum insulating gel. **Fig. 23** The unpolished bridge after wiping off the Signum insulating gel. **Fig. 24** Finally, the level of glaze can be further optimised using a wool buff. **Fig. 25** Overpressing the shade characterisation with enamel achieves a naturally looking restoration.


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Conclusion

The Signum composite system provides users with an innovative veneering system that is oriented to the latest fabrication processes and covers a wide range of applications. In addition to standardised veneering, which is easily implemented using dentine and enamel, the system also provides users with every possibility of stabilising and characterising the shade thanks to the individual adjustment options of the Signum stains that are suitable for 3D (Fig. 29 to 31).

As already discussed in detail, this reproducible veneering technique can also be classified in the now well-known and repeatedly published triple layering technique TLT© of the author. The technique involves forming the customised section using Signum stains and then overpressing the light filter with Signum opal incisal.

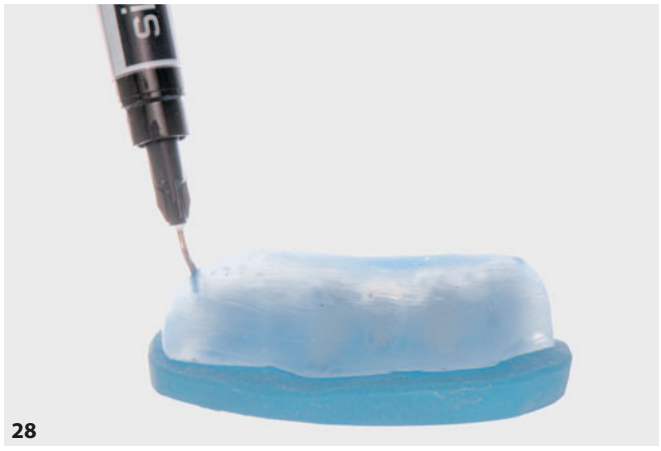
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Fig. 26 Thanks to the 3D staining option a more customised, age-appropriate characterisation is easily realisable. **Fig. 27** As the viscosity of the stains is individually adjustable, extensive and selective three dimensional effects can be easily reproduced. **Fig. 28** The initially polymerised stains are overpressed using opal incisal. **Fig. 29** The restoration can be finished by applying glaze or polishing.

Acknowledgement

The author would like to especially thank the dental team Sulzberg of Roland Binder, which with its know-how in the field of additive fabrication was and is a valuable partner in creating the article and beyond.

Information

A video can be viewed under this QR code on the use of the composite heater referred to in the article.

ZTM Björn Maier
Ludwigstr. 10
89415 Lauingen
Germany
E-Mail: info@bjoern-maier.com

Fig. 30 Thanks to the 3D staining a naturally looking veneering outcome is achieved. **Fig. 31** There is no difference between the finished restoration and a customised build-up, however, the time required is significantly reduced.