The whole world of prosthetics

The Dental Lab

SPECIAL EDITION

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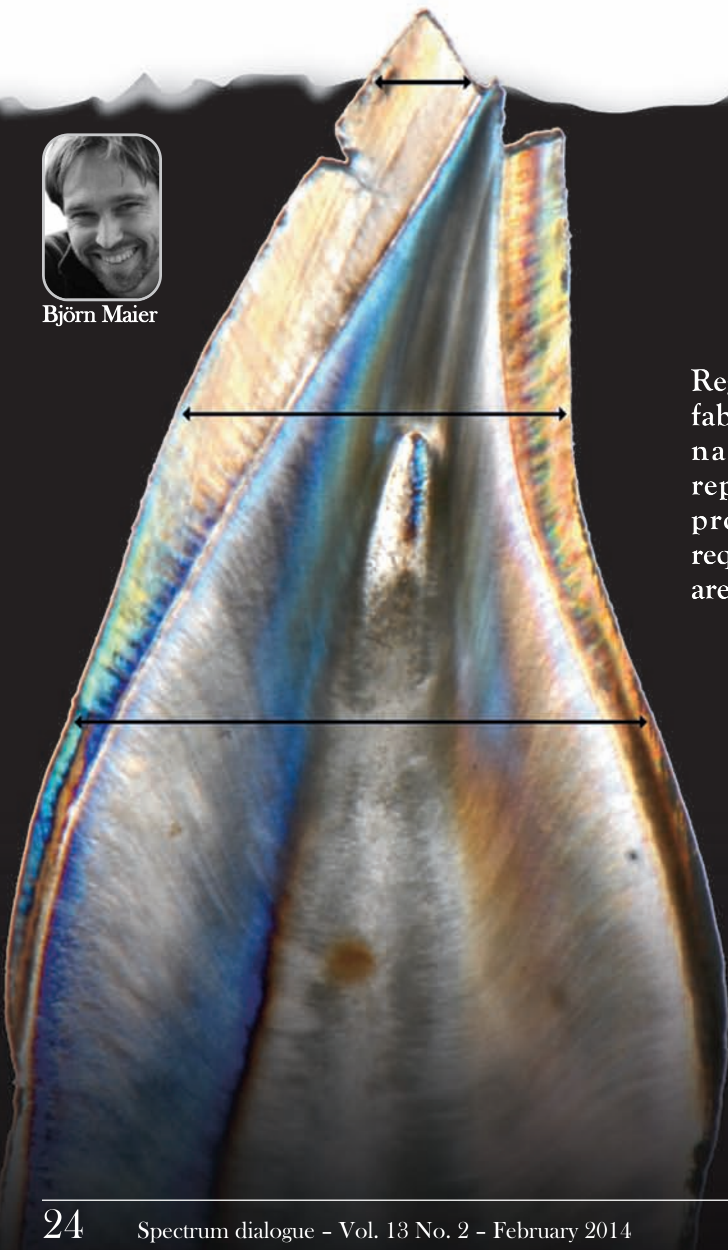

Regardless of the type of dental prosthesis being fabricated, it is always about recognizing the natural features of light dynamics and replicating them in the smallest detail using proven and reliable materials (Fig. 1). The requirements regarding modern dental ceramic are accordingly demanding.

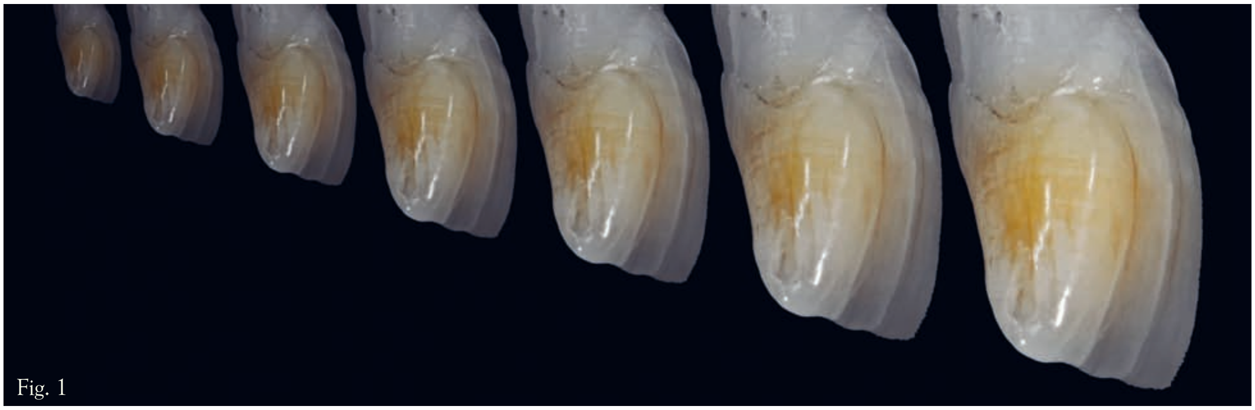

Fig. 1

Apart from a wide processing spectrum (metal framework, zirconia framework, lithium disilicate framework), efficient layering concepts aimed at meeting high aesthetic demands such as light transmission, reflection and absorption are expected.

Processability (degree of humidity, positional stability, firing settings, bond strength etc.) is also a criterion that has to be fulfilled in order to ensure a successful processing. The time required for a bond modification between the framework and the veneering ceramic as well as the shade stability shall also be taken into account.

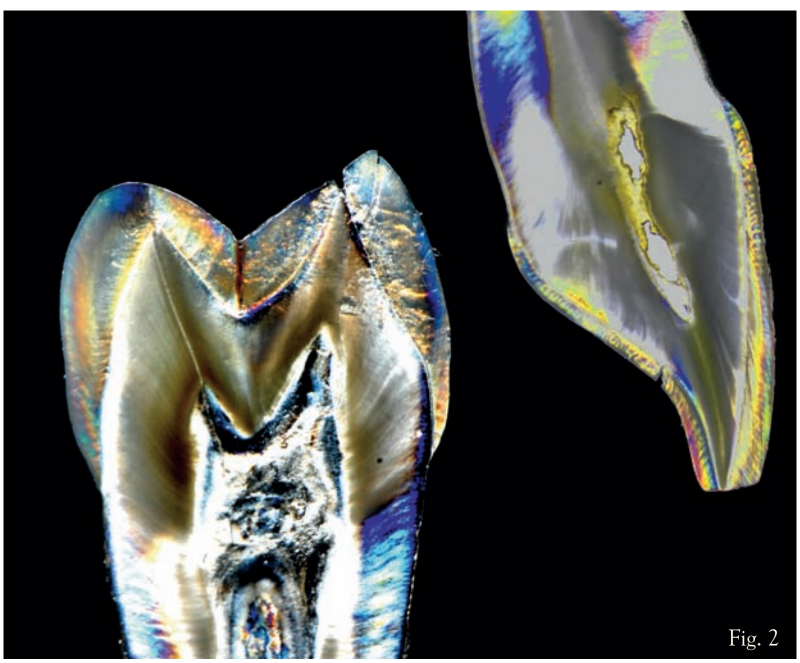

Fig. 2

Fig. 1: A modern veneering ceramic must be able to create the illusion of light dynamics.

Fig. 2: The light dynamics of a natural tooth is generated on a volume of 5 to 6mm.

Introduction

When making ceramic restorations, the clear objective is to recreate the specific characteristics of a patient or to improve them. In order to achieve this, an in-depth patient analysis needs to be conducted so as to define the aesthetic guidelines and translate them into reality.

The success factors are the shape, the size and the colour. These three aspects define the whole aesthetics. Two-thirds of the task is certainly carried out by the dental technician, who must master his craft and bring the relevant experience and right intuition to guarantee a successful implementation.

Another criterion that must not be underestimated is the veneer assortment. It does not only reveal the physical properties but also enables maintaining the shape and colour properties during the firing process. The dental technician needs a material with positional stability and optical characteristics such as light transmission and light dynamics. Modern veneering systems must be able to keep these criteria stable throughout the firing process.

Requirements for veneering ceramic

The great challenge with first-class hybrid ceramic consists in creating a perfect illusion on a 1 to 2.5mm layer just as nature does on a 5 to 6mm layer (Fig. 2).

The requirements for veneering ceramic are thus clearly defined. It must be possible to reproduce all tooth shades and properties in this small available area.


Fig. 3


Fig. 4


Fig. 5


Fig. 6


Fig. 7

When looking closely at natural teeth of various ages, it can be seen that – apart from morphological aspects – there is quite a lot of colour and light-optical properties. These range from strong opalescent effects in the incisal area of young people to transparent and translucent effects among elderly individuals (Figs. 3 to 7).

Other important criteria for the long-term success of time consuming, custom-made restorations are the physical properties of a ceramic. With the variety of framework materials and anchorage bases, tensile and compressive forces as well as the values of the bending tensile strength are crucial. Especially in the area of implant works, cantilever bridges or Maryland bridges, the requirements regarding the framework and veneering are very demanding (Figs. 8 to 11).

Processing

The actual veneering requires a logical assortment system and a consistent layering concept to

Fig. 3: Teeth with a youthful appearance are highly opalescent.

Fig. 4: By lowering the brightness, colour properties can be strongly enhanced.

Fig. 5: As one ages, the opalescence tends to diminish due to abrasion and calcification.

Fig. 6: Calcification increases with age ; the incisal area becomes more translucent.

Fig. 7: The described characteristics must be replicated using a modern veneering ceramic, and this regardless of the framework.

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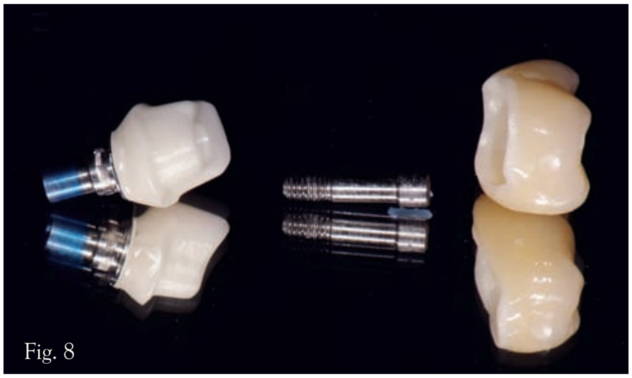

Fig. 8

Fig. 9

Fig. 10

Fig. 11

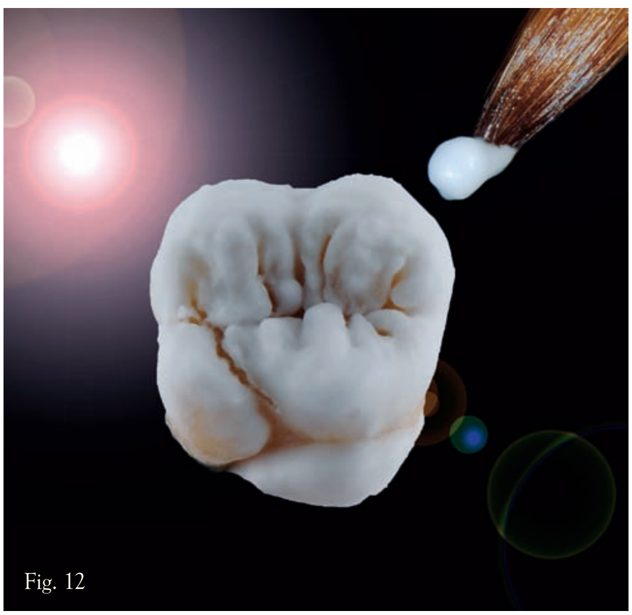

Fig. 12

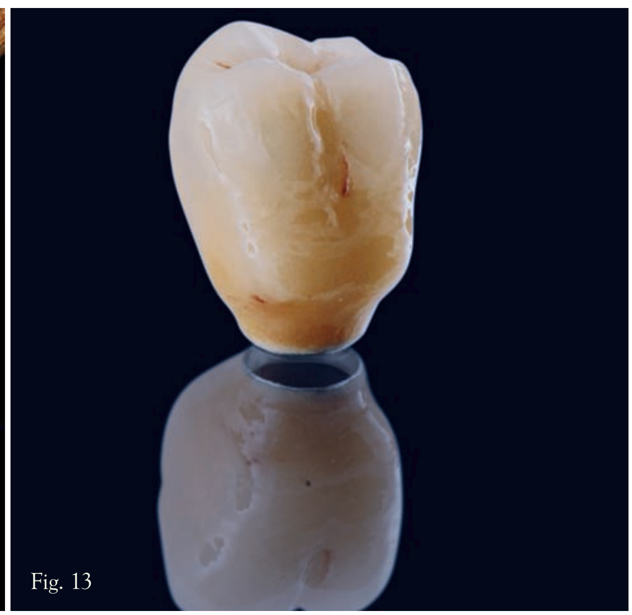

Fig. 13

Fig. 8: Compressive and shearing forces on ceramic-veneered implant restorations are very high due to missing receptors.

Fig. 9: High pressure and tensile load in cantilever bridges

Fig. 10: Strong bonding within the veneering ceramic is all the more important as a framework is not provided.

Fig. 11: In long-span restorations, compressive and tensile forces are very high.

Fig. 12: Positional stability and a constant degree of humidity are the prerequisites for accurate modelling.

Fig. 13: A high level of firing stability allows an exact replication of the shape.

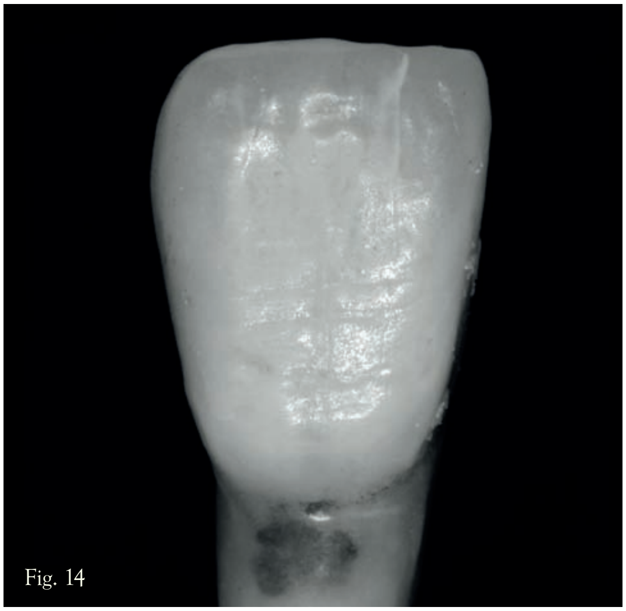

Fig. 14: The brightness increases from cervical to incisal whereas the chroma increases from incisal to cervical.

Fig. 15: Basic build-up to set the chroma

Fig. 16: Individual characteristics are layered onto the basic build-up.

achieve clearly defined goals. The positional stability of the material as well as the shrinkage behaviour must remain constant within the product range. Thus, the operator can efficiently fabricate individually tailored restorations that can satisfy the requirements of high-class aesthetics and function on a daily basis. (Figs. 12 and 13).

This procedure is divided as follows:

1. Framework modification (bond strength)
2. Basic build-up (chroma)
3. Individualization (incisal characteristics)
4. Surface conditioning (structure and glaze firing).

Framework modification and basic build-up

Framework modification includes two essential tasks: on the one hand, the adhesion between the base and the veneering is established, on the other hand, shade stability should be guaranteed by conditioning the framework.

In the veneer assortment of ceraMotion, the optical properties of a metal-based veneering and a zirconia-based veneering are identical. Hence, the described procedure is limited to zirconia-based frameworks.

In the case of zirconia-based frameworks, a distinction should be made between through-coloured or non-coloured frameworks. Through-coloured frameworks are directly fired with the facing materials of the ceraMotion system. Framework modification and basic build-up are performed in a single operation. This can help improve the cost-effectiveness in laboratories.

In perfect alignment with this is the vibrantly coloured 'Base Dentin' of the ceraMotion system which enhances the chroma effect. To individually adapt the shade gradient from cervical to incisal, the system provides shade modifiers such as the 'Dentin Modifier Materials'or the 'Chroma Concept Materials' which also improve the chroma value (Figs. 14 and 15).

Individualization

When it comes to individualize the restoration, a precise imitation of the specific patient characteristics is required. At this stage, the reliability of the veneer assortment is of utmost importance. Based on the elementary layering which includes the chroma and colour brightness, the individual characteristics are built-up using the sandwich technique. Such an efficient procedure requires an assortment that guarantees consistent positional stability, uniform shrinkage behaviour and unvaried light dynamics of the ceramic materials.

According to the intended restoration, the operator can choose between chromatic, opalescent, transparent and translucent shade modifiers within the ceraMotion system (Figs. 16, 17, 18 and 19).

The chromatic materials of the assortment are especially designed to properly set the chroma. Hence, these materials are preferably used in the cervical third of the restoration. In the incisal third, they are used to mimic the colour-saturated mamelon structures and to generate the Halo effect (Fig. 20).

When shaping the incisal, the aim is to replicate an age-appropriate light dynamics. In other words, different light conditions and a modification of the viewing angle help to achieve a 'natural and lively interplay of colours'.

When looking at different age structures, a distinction can be made between transparent, opalescent and translucent incisal areas.

Transparency refers to a very high level of light transmission. It can be defined as the relation between the incident luminous flux and the luminous flux cutting through.

Transparency is thus a property displayed in areas with little tooth substance (Fig. 21). To replicate this, materials with accordingly low opacity are needed. At the disposal of the operator are the 'Transpa T materials' of the ceraMotion assortment whose level of opacity is lower than 32%.

With this material, the technician can mimic highly transparent areas without weakening the underlying features.

Creating youthful-looking incisal characteristics requires a material that exhibits opalescent properties. This blue appearance is generated by the reflection of light.

Opalescence is a term originating from a mineral: the opal.

Natural opal is made up of a dense silicone dioxide structure. The empty gaps are filled with water. This composition makes the mineral look bluish milky when viewed under incident light. This phenomenon occurs because the proportion of blue in the light ray (short wavelength) is interrupted and reflected by the fine water particles.

In natural teeth, the enamel assumes the role of the spectral filter. The opalescence is generated by the prism structures of the enamel. In ceramic materials that have been especially developed to produce this effect such as the 'ceraMotion Opal Blue' (Fig. 22), the glass-to-metallic oxide-ratio is crucial for maintaining a natural-looking enamel even when the angle of light incidence has been modified.

As natural teeth are vital tissues, they will match the physiological and pathological stimuli of their environment during the aging process. As one ages, dentinal tubules supplying the enamel start to calcify. The opalescent effect tends to increasingly diminish as a result of this change and switches to a translucent appearance.

The term translucency is used to describe objects that do not enable a clear identification of the entity behind. As the light hits the body, some part of it may penetrate but will be also scattered. The higher the scattering of light, the greater the turbidity of the substance. The 'Incisal Modifiers' of the ceraMotion assortment have been developed to cover this area. Thanks to the well-organized ceraMotion-assortment, individual, patient-oriented results can be achieved. In addition to having a good knowledge of the colour properties, the technician should know the aforementioned degrees of saturation (transparency). The opacity determines the layer build-up (Fig. 23).

Glaze firing

After dentine firing, restorations can be trimmed with ceramic-bonded stones or diamond-coated

Fig. 17

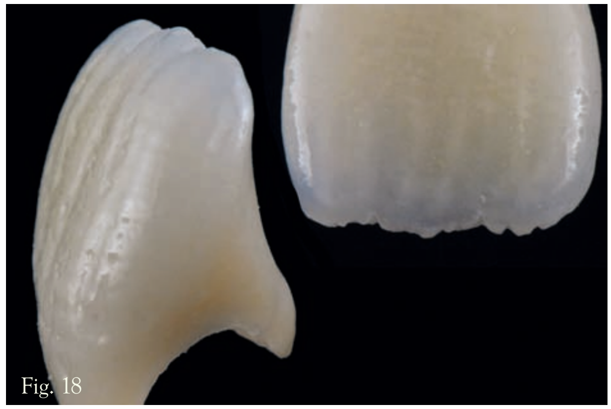

Fig. 18

Fig. 19

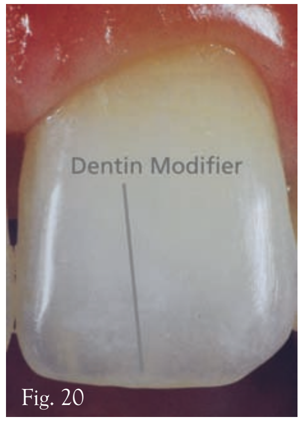

Fig. 20

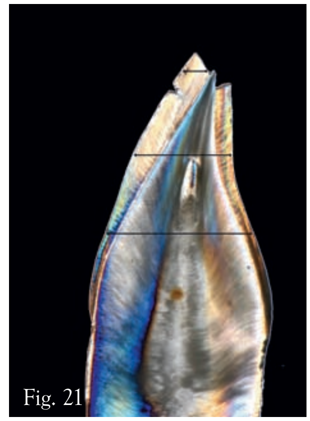

Fig. 21

Fig. 22

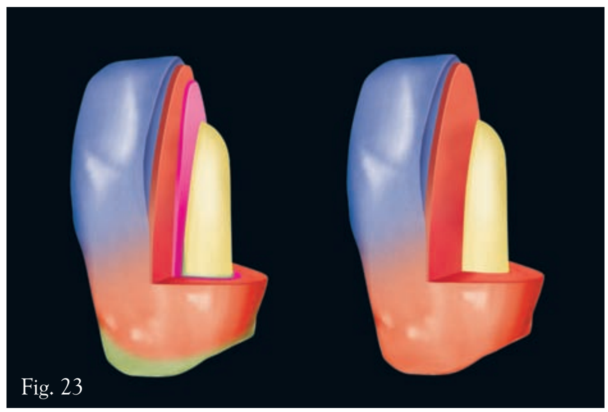

Fig. 23

Fig. 24

Fig. 17: The result after firing

Fig. 18: Restoration of a young tooth

Fig. 19: The required opalescence is obtained by applying 'Incisal modifier opal blue'.

Fig. 20: Final application of a highly saturated ceramic material achieves controlled light transmission.

Fig. 21: The transparency diminishes as the tooth volume increases.

Fig. 22: The properties of the opalescent effect material are inspired by the 'opal', a natural mineral.

Fig. 23: Build-up with and without 'Base Dentin'

Fig. 24: Thanks to the glaze firing, the surface of the object is provided with glazing – the guarantee against split offs.


Fig. 25

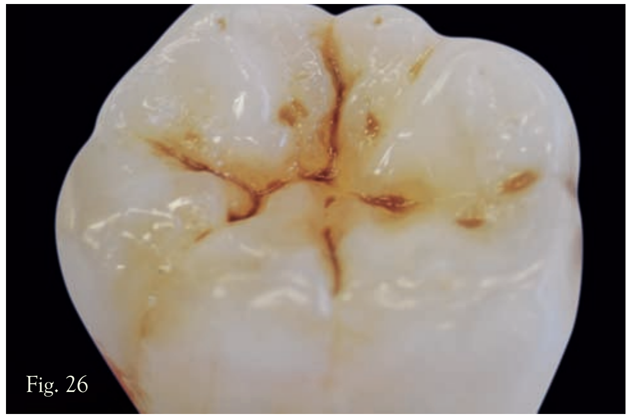
Fig. 26


Fig. 27

Fig. 28

Fig. 29

Fig. 25: Stains help easily mimic colour properties.

Fig. 26: Characteristics such as discoloured fissures or abrasions can be replicated under controlled conditions.

Fig. 27: Through targeted application of stain liquid and glaze material, additional abrasion properties can be mimicked.

Fig. 28: Thanks to the low-fusing adjustment assortment, refinishing can be performed on a sturdy layer and with stable colours.

Fig. 29: The pontic contour can be subsequently adjusted with the 'Touch Up' materials.

instruments. Thanks to the good firing stability of ceraMotion, trimming is restricted to the surface morphology provided modelling has been scrupulous.

The growth structure is carved out with regard to age and then cleaned.

The final glaze firing seals the tooth surface (Fig. 24). This working step can also be used to give the restoration its final characterization. Thanks to the fine-grained stains, it is quite possible to subsequently adjust the colour (Figs. 25 and 26). The glaze level of the respective areas can be controlled through targeted application of stain liquid and glaze material (Fig. 27).

Adjusting ceramic restorations

The adjustment of finished restorations requires, in most systems, a lot of tact. Refiring the ceramic can change the shape and light dynamics very quickly. Therefore, having an adjustment assortment in the system would be a big advantage.

Fig. 30: Individualization of lithium disilicate frameworks

The ceraMotion system includes the Touch Up set which enables the operator to fire contact points and pontics at a later stage using low-fusing ceramic materials. (Figs. 28 and 29). This set is divided in various saturated materials and ensures the positional stability of the shape and colour.

Conclusion

Requirements regarding veneer assortments are high. Today, it is no longer enough to offer a system that achieves highly aesthetic restorations. A modern ceramic veneer system must also cover a broad range of framework materials. Besides metal-ceramics and zircon dioxide, a veneerable lithium disilicate (Fig. 30) is gaining more and more importance. The lab will thereby have an assortment that enables working with all materials following the same layering technique. This will broaden the application area making the veneer system economically attractive. Sd