

dental dialogue

THE INTERNATIONAL JOURNAL OF DENTAL TECHNOLOGY

WWW.DENTDIALOGUE.DE

B53466

© Copyright 2016 Teamwork Media Fudistal • © Co

REPRINT

ONE ZIRCONIA TO RULE THEM ALL

Carsten Fischer



PRESENTED BY **HENRY SCHEIN**

TEAM
WORK
MEDIA



Henry Schein offers Zirlux 16+, a translucent zirconia material with high shade fidelity

ONE ZIRCONIA TO RULE THEM ALL

Carsten Fischer, CDT, Frankfurt, Germany

CONTACT

- Carsten Fischer
sirius ceramics
Lyoner Straße 44-48
60528 Frankfurt am Main
fischer@sirius-ceramics.com
www.sirius-ceramics.com

WEBSITE



DD-CODE

- **c1r23**
Enter this dd code in the search box
on www.dentaldialogue.de to access
additional content



Initial doomsday predictions that the half-life of the zirconia “fad” would be short have been gradually silenced. The material properties of modern zirconia materials are impressive. They can be used for more and more prosthetic restorations and are increasing accepted in the lab technician’s everyday work. In this article, Carsten Fischer presents the highly translucent zirconia shade system Zirlux 16+ by Henry Schein, demonstrating how versatile this modern zirconia material can be if handled properly and the right processing and customization techniques are used.

KEY WORDS

- Shade fidelity
- Generation
- Monolithic
- Translucency
- All-ceramics
- Zirconia



01 The Zirlux 16+ system zirconia is multifunctional and well-conceived. A special feature is that the dental laboratory can offer its dental customers – and thus the patient – different performance levels for one and the same indication.

“If I had one wish free, it would be for...” A few years ago, this phrase would have been quickly completed by many dental technicians roughly like this: “... a high-strength material, with good optical properties similar to glass ceramics, which can be easily transformed into restorations offering long-term stability.” Today, we can wish for every dental technician to learn about the benefits of a comprehensive 3rd-generation zirconia shade system (such as Zirlux 16+ by Henry Schein) and be “infected” by the zirconia bug.

**3rd-generation zirconia:
A material of choice**

We have been working with zirconia in our laboratory for more than 15 years now and have of course closely followed the development of this material during this period. We follow established technical rules to ensure the correct processing of zirconia on an everyday basis. Many parameters (e.g., with regard to the framework design) have long been known and are respected in full today. This is brought down the number of failures massively. The initial scepticism that had met zirconia has subsided, not least because an extensive range of studies is now available.

Hardly any other dental material has been studied as extensively in the past fifteen years as zirconia. It was observed, among other things, that the bond strength between zirconia and veneering is good. If fractures do occur, they will be found in the weakest link of the chain, the ceramic veneer [1].

We all know that zirconia frameworks must be designed to offer anatomic support and that the regions supporting cusps must be rounded. The load at fracture is increased in this manner, keeping the risk of chipping small [3]. Scientists have also published clear statements regarding the supposedly increased abrasion caused by zirconia. It is not the hardness of the material that causes damage to the antagonist, but its surface structure [5, 6]. This insight has led to rules that tell the technician exactly how to work the material, for example by ensuring a highly smooth surface or by polishing the surface in the patient’s mouth. The initial problems with the materials have thus been eliminated.

Modern zirconia materials can be processed safely and enjoy a high level of acceptance in prosthetic dentistry. The current marketed

zirconia materials have been designated third-generation zirconia. Compared to the 1st and 2nd generations, this group of materials exhibits a significantly higher translucency due to its specific (mixed cubic/tetragonal) structure. The cubic crystals have a comparatively large volume, so the light is not scattered as much at the grain boundaries, which is why the translucency is higher. The cubic crystal structures allow the incident light to be reflected uniformly in all directions, additionally increasing the translucency [2, 4].

The Zirlux 16+ zirconia portfolio

The 3rd generation of zirconia materials also includes the latest product within the Henry Schein Zirlux portfolio: Zirlux 16+. The new shade system includes zirconia discs and blocks pre-shaded in the 16 shades (A1 to D4) of the Vita classical shade guide, which can additionally be stained individually. This encompasses an extensive and diverse range of shades, meaning that each tooth shade can be reproduced exactly according to the Vita shade system. The highly acclaimed material properties of zirconia, such as flexural strength and fracture toughness, remain un-



02a - c 1st performance level: Glaze & Go. Monolithic zirconia restoration made using the Glaze & Go concept. This means that the restoration has been milled monolithically and finished with a glaze firing.



03a - c 2nd performance level: Stain & Glaze. Monolithic zirconia restoration made using the Stain & Glaze concept. In this variant, the monolithic zirconia restoration is individually stained and glazed.



04a - c 3rd performance level: Bake & Glaze. Veneered anterior restoration made using the classic Bake & Glaze concept. Here, a zirconia framework that provides the shade foundation is veneered manually.

affected. The high translucency of the material, natural light dynamics and high shade fidelity to the dental technician with Zirlux 16+ create almost unlimited possibilities for the dental technician. Since shade accuracy is basically dependent on many processing-related factors, the present article is dedicated to the application of Zirlux 16+ zirconia in daily laboratory use. The Zirlux 16+ system is multifunctional and well-conceived. It offers the prefabricated 16 shades of the Vita shade guide plus two bleach shades. A special feature of Zirlux 16+ is that we can offer our dentist customers and their patients various Zirconia performance levels. This gives us one material for all situations (Fig. 1).

Performance level 1: Glaze & Go

The restoration is monolithically milled and sintered and can be prepared for insertion by a glaze firing step (Figs. 2a-c). This indication may be a bit of an eyesore to many dental technicians. Yet this kind of restoration is requested more and more frequently. Zirlux 16+ provides goal-driven solutions for adequate results.

Performance level 2: Stain & Glaze

This indication is the one most often encountered in our daily work. The restoration is monolithically milled and can subsequently be individually stained and glazed with suitable materials (Figs. 3a-c).

Performance level 3: Bake & Glaze

This indication, too, is of course part of our daily workload. This is where we our back in classical dental technology, "manufacture" style. The zirconia framework serves merely as a colour-bearing base for individual veneering (Fig. 4a-c).

These three performance levels cover a wide range of different expectations. But this selection can still be topped, which in aesthetically highly demanding cases results in further optimization of the optical properties. The Zirlux 16+ material (white) can be customized with suitable modifier liquids (sirius ceramics) to create smooth shade transitions. When staining, we have a



05 The variability of the of Zirlux 16+ shade system makes for a broad range of indications for the dental laboratory: from demanding anterior restorations and monolithic posterior restorations (single crowns to multi-unit bridges) to hybrid abutments – all with the same zirconia material and its associated concept.



06 Comparison of various materials for anterior restorations illuminated by different light sources: the attractive light dispersion with Zirlux 16+ is clearly visible.

choice between simple immersion (dipping technique) and the multi-colouring brush technique. The latter is able to give a monolithic restoration the multi-shade appearance patients so often expect today.

This method, which we help develop at the time, has been successfully used for many years and has now also adapted for the Zirlux products. The extensive variability of Zirlux 16+ when it comes to shades opens it up for use in a broad range of indications, whether sophisticated anterior restorations, monolithic posterior restorations (single crowns to multi-unit bridges) or hybrid abutments (Fig. 5). This material gives the dental laboratory a high degree of flexibility, which benefits efficiency and cost-effectiveness. With regard to the optical properties (Fig. 6), Zirlux 16+ provides a viable alternative to

glass ceramics. In addition, this zirconia system covers a much wider range of indications, including long-span bridges or implant-prosthetic components. Compared to other materials (such as AnteriorZirkon), we find good light dispersion and light absorption properties as well as high translucency – without compromising the high strength of 1,200 MPa. This is truly unique.

It is also noteworthy that Henry Schein hardly lists any limitations for Zirlux 16+ and prescribes no standards (within the approved indications). This means that every laboratory, every dental technician can be inventive and make the best possible use of this material to match personal ideas, budget constraints or patient expectations in terms of the resulting ceramic restoration.

Technical application details

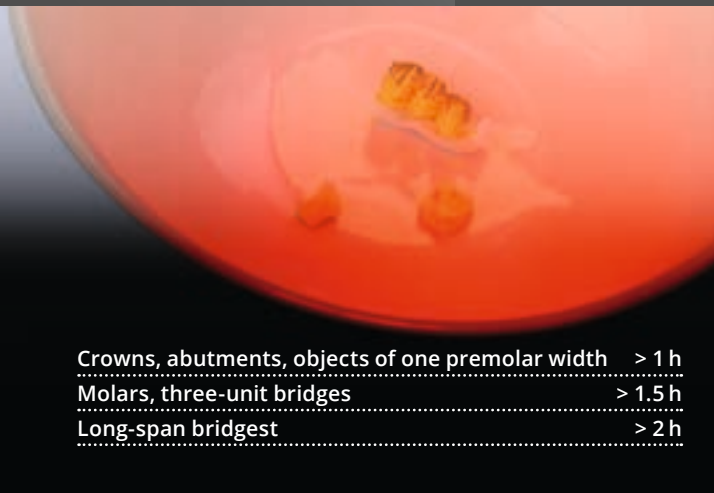
But even the best material cannot reach its full potential if the specific rules for its application are not respected. Shade fidelity and long-term stability depend on many different processing-related factors. (Note that the details of the CAD design of a zirconia framework are beyond the scope of the present article.) Frameworks for veneering are generally designed to an anatomically reduced contour. The framework constitutes the shade-bearing foundation for the veneer. Generally recognized design criteria and other parameters (such as the minimum diameters of connectors in bridge designs) must be complied with.



07a Zirlux 16+ ingots are available for all standard milling machines.



07b & c Coordinated carbide cutters must be used for all steps prior to sintering – this also holds true when processing of chalk-like unsintered zirconia.



Crowns, abutments, objects of one premolar width > 1 h
 Molars, three-unit bridges > 1.5 h
 Long-span bridgest > 2 h



08 Drying times for colored unsintered zirconia. All times listed are recommendations only and are subject to laboratory-specific design and fabrication criteria.

09 The Zirlux 16+ restorations have their own sintering curve which must be observed strictly.

Between milling and sintering

Zirconia is a highly sophisticated material and must be treated accordingly (Fig. 7a). The steps after milling the restoration should follow a consistent procedure. Careful work is required already during the pre-sintered state (green compact). The chalky-soft milled object facilitates easy adjustments, but has to be treated with appropriate care because of its still limited strength. Adjustments before sintering take place in the dry state. The milled object is ideally separated from the disk with a long, pointed carbide cutter that can be guided with great precision (Fig. 7b).

To quickly achieve the desired result after sintering, the surface should be previously smoothed with special cross-cut cutters

(Fig. 7c) and special rubber polishing cups and tips (sirius ceramics). For a clean surface finish, special milling cutters and rubber polisher's must be used that achieve a well-defined surface roughness. If the zirconia was stained before sintering, care must be taken to ensure adequate drying (Fig. 8). The objects must not contact each other as they are positioned in the sintering tray. The sintering parameters must be observed strictly (Fig. 9). We work exclusively with water-based staining liquids, so that no specific protection for the firing chamber is required.

Some important processing criteria

- No sharp corners or edges on the framework
- Reduced anatomic framework design

- Adequate connector cross-sections
- Dry and sensitive handling of the framework prior to sintering
- Clean processing of the surface before and after sintering
- Correct sintering temperature and heating and cooling rates during firing

Finishing a monolithic restoration

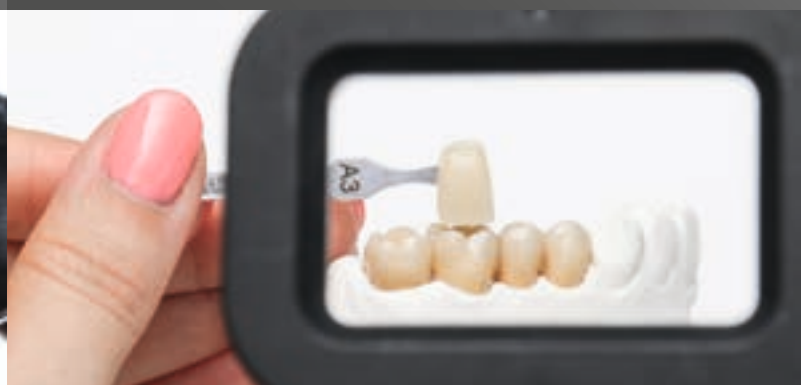
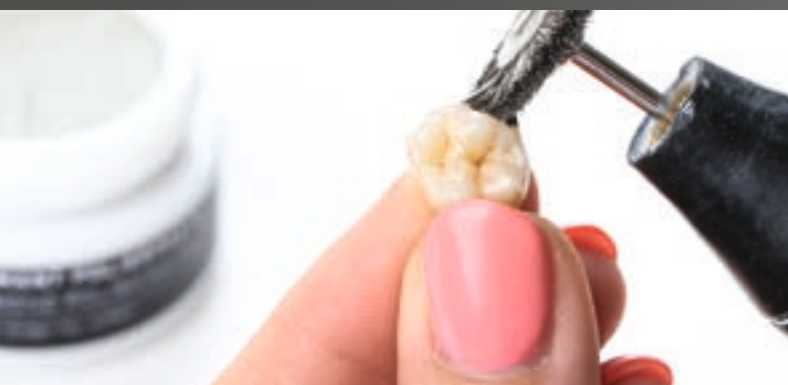
After sintering, it will become obvious that the perfect basic shade as specified during shade-taking has been matched by the Zirlux 16+ restoration. In theory, the work can now be completed with a glaze firing. Alternatively, the restoration can be customized with stains and finished afterwards (Fig. 10), in which case it is recommended to



10 With Stain & Glaze, the zirconia restoration is monolithically milled and then stained and glazed individually with appropriate materials.



11a & b After the characterization and glazing of monolithic zirconia restorations, the surface should always be finished and polished according to a previously defined polishing protocol.



12 & 13 The final surface finish always consists of high-gloss polishing with brushes and a special polishing paste (left). The accuracy of the shade reproduction with Zirlux 16+ is impressive (right).

select the Zirlux 16+ ingot that is brighter by one level than indicated by the Vita classical shade. This gives the technician the ability to produce a natural-looking gradient from the cervical to the incisal aspects using stains while still being confident to match the desired tooth shade.

Scrupulous manual polishing is essential prior to glaze firing (Fig. 11). It is not enough to condense the surface by the glaze firing, as the glaze layer may be abraded over time, exposing the unfinished zirconia surface. These rough and hard exposed areas can in turn cause damage to the antagonists. We prefer to polish the zirconia surface with diamond polishers developed specifically for this treatment protocol. The final polishing is done using a handpiece with small brushes and diamond polishing paste (Fig. 12). The result thus achieved will exhibit excellent shade accuracy (Fig. 13).

In a comparison of the two performance level (where 1 is Glaze & Go and 2 is Stain & Glaze), the differences are most discernible in terms of the optical properties (Figs. 14 to 16).

Enter ... colour!

There will always be situations where we want to go a step further and achieve a little bit more. Here it will be advantageous if we have some extra scope for achieving the optimal optical properties of an absolutely natural-looking restoration. For these cases we can use the Zirlux 16+ (white) material and a sophisticated staining concept. To characterize the milled, monolithic zirconia crowns, the white unsintered bodies are infiltrated with staining liquids, using either the dipping or the multi-colouring technique.

The dipping technique

In the dipping variant, the restoration milled from the white Zirlux 16+ blank will be submerged in the shade-appropriate dyeing liquid and completed in a few steps: dipping, drying, sintering, glazing. This option is useful for labs that want to keep their inventory low and do not have or wish to keep all 16 colours of discs in stock. In this case, only the most probably tooth shades must be kept in stock as prefabricated pre-shaded discs. Even in the case of less frequently used tooth shades, it is possible to resort to the white ingot and the dipping technique.

Note that it is important when characterizing zirconia to properly dry and pre-dry the material prior to sintering. This avoids any back-pressure during the sintering phase potentially caused by residual liquid (cf. Fig. 8).



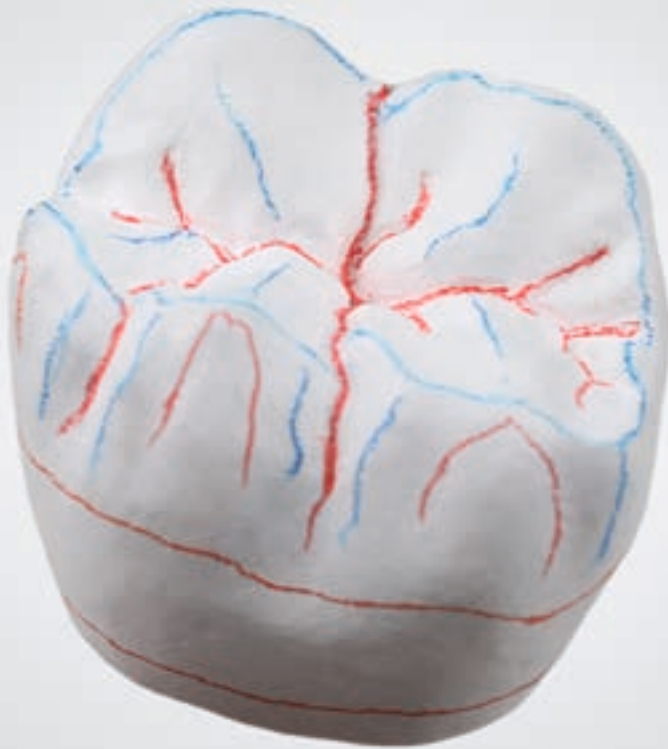
14a & b Monolithic zirconia restoration in the maxilla. The restoration was realized at performance level 1 (Glaze & Go). It exhibits adequate aesthetics and must be matched with the individual expectations of the patient.



15a & b The restoration was realized at performance level 2 (Stain & Glaze). The monolithic zirconia crowns were stained and then glazed.



16 The monolithic Zirlux 16+ crowns look naturally and show a beautiful translucency. The lateral view shows the differences between the stained and glazed (mandibular) and the glazed-only (maxillary) variant.



17a - f If a smooth shade gradient is desired for a restoration, the multi-colouring technique is used. Here, the targeted application of a modifying liquid creates natural-looking shade transitions. To achieve reproducible results, a pre-defined staining scheme should be followed and exactly matched materials used. The areas to be shared are first sketched on the restoration. In the case of a molar crown, those areas may number up to five.

The multi-colouring technique

If, however, a smooth shade gradient is desired rather than a monochrome restoration, the multi-colouring technique is available. By selective application of a staining liquid, a restoration with natural-looking shade

transitions can be achieved (Fig. 17). For example, the occlusal surfaces of posterior restorations or interdental areas can be designed chromatically and amelons can be accentuated with the respective modifier liquid. To achieve reproducible

results, a designated staining scheme must be followed and exactly matched materials used. For many years we have been working with Colour Liquid Aquarell Colour Liquid WaterBased staining liquids by Zirkozahn.



18a - d Multi-Coloring Advance: The modifying liquids in blue, grey and purple provide further support for a natural-looking depth effect.

We start by creating a sketch of the restorations where the areas to be stained are drawn, like on a map. In the case of a molar crown, those areas may very well number up to five. These areas are then filled with the appropriate staining liquid, not unlike “painting by numbers”. If the staining plan is painstakingly followed, the result will be wonderful shade gradients and a vivid internal colour interplay.

Multi-Coloring Advance

But Zirlux 16+ offers another, surprising, variant “on top”: Multi-Coloring Advance. With additional blue, grey or purple modifying liquids, a natural depth effect can be achieved that is widely expected of a ceramic restoration. In this way, zirconia restorations, previously often dismissed as “lifeless”, display a lively interplay of internal shades (Fig. 18).

In the clinical case presented here to illustrate this indication, anterior restorations were to be provided, namely all-ceramic single crowns on teeth 22 to 12. Following our standard procedure, a wax-up was made that the dentist converted to a mock-up and tried in in the patient’s mouth. The framework design was based on the digital wax-ups, which had been reduced in the software for this purpose. After milling the framework copings from Zirlux 16+ to an anatomically reduced crown contour, the copings were stained using the multi-colouring method, creating a perfect shade foundation for the individual veneers.

The perfect optical properties are best viewed in transillumination. The translucency in the incisal area already gave a hint that the finished restoration would have very vivid shade effects. Only a few firing cycles

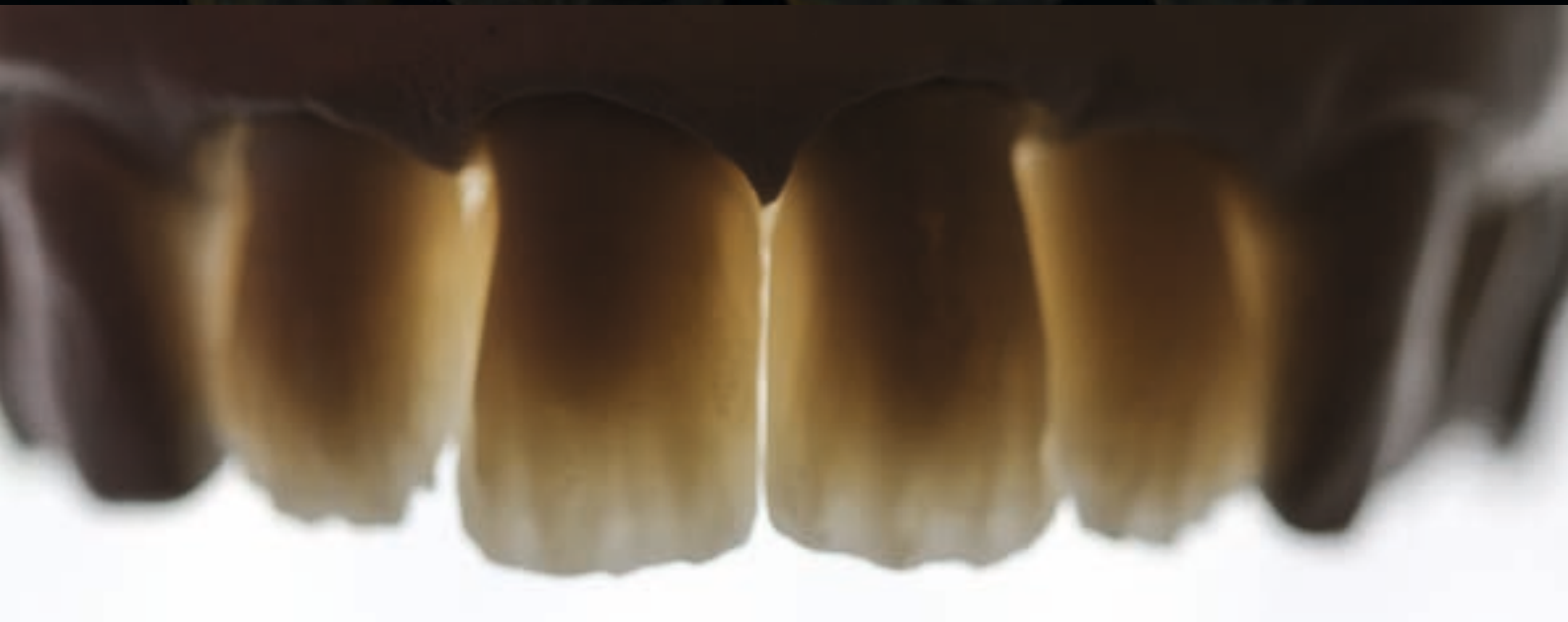
and a thin ceramic layer were required for the ceramic veneer. After incorporation of a macro- and microstructure modelled on the adjacent teeth, the four crowns were polished and finished manually. Once in the mouth, the all-ceramic crowns exhibit beautiful shade characteristics and the predicted very attractive translucency in the incisal region (Figs. 19 to 22). Just what dental technicians are always striving for.

Conclusion

With Zirlux 16+, Henry Schein has managed to outwit the inherent aesthetically limitations of conventional zirconia, giving the dental technician dental technician a comprehensive zirconia and shade system with very considerable variability. The three performance level described (1 – Glaze & Go, 2 – Stain & Glaze, 2 – Bake & Glaze) and



19a & b In this patient, the four maxillary anterior teeth were to be restored. Owing to the pre-existing restorations, a minimally invasive approach was not feasible. The prepared teeth only had to be slightly adjusted and re-prepared for all-ceramic crowns with zirconia frameworks.



19c & d This zirconia frameworks (Zirlux 16+) were prepared according to the Multi-Coloring Advance method. They represent a slightly reduced crown contour and can accommodate a minimum-thickness veneer that facilitates a very lively result.



19e & f It is a very good idea to mill the desired result in wax ahead of time to have maximum control of the tooth shape during ceramic build-up.



19g The finished zirconia-based crowns on the cast. The combination of individually stained, highly translucent zirconia frameworks and a subtle ceramic veneer resulted in very pleasing restorations. Restaurationen



20 The Zirlux 16+ zirconia material achieves a maximum of shade fidelity (and, hence, natural appearance) due to the exact basic shades and the staining concept, even if only limited space is available.

the "on top" staining possibilities provide a multitude of restorative options. Inherent limitations are a thing of the past. Zirlux 16+ is the zirconia material "to rule them all" that can be used for just about any indication. Procedures can be selected flexibly

depending on patient expectations, financial circumstances and the dental technician's specific skills. The shade properties after completion will always be adequate – and reproducible.

The author and his lab team would like to thank the dental offices of *Dr Rafaela Jenatschke*, Frankfurt (www.your-smile.biz) and *Dr Peter Gehrke*, Ludwigshafen, as well as the entire team of *Prof Dr Dhom & Kollegen MVZ GmbH* (www.prof-dhom.de).



21a & b With a highly translucent and additionally custom-stained zirconia material such as Zirlux 16+ we will always be on the safe side: thanks to the mixed cubic/tetragonal structure, the optical properties could be significantly improved without reducing the high strength of 1,200 MPa. This results in highly aesthetic ceramic crowns that are beyond reproach.

REFERENCES

- [1] Heintze SD1, Rousson V. Survival of zirconia- and metal-supported fixed dental prostheses: a systematic review. *Int J Prosthodont.* 2010 Nov-Dec;23(6):493-502.
- [2] Janyavula S, Cakir D, Beck P, Ramp LC, Burgess JO. The wear of polished and glazed zirconia against enamel. *J Prosthet Dent* 2013; 109:22-29
- [3] Stawarczyk B, Jahn D, Becker I, Fischer J, Hämmerle CHF Einfluss des Gerüstdesigns auf die Bruchlast von ZrO₂-Kronen. *Quintessenz Zahntech* 2008; 34:1246-1254
- [4] Stawarczyk B, Keul C, Eichberger M, Figge D, Edelhoff D, Lümke N: Werkstoffkunde-Update: Zirkonoxid und seine Generationen. *Quintessenz Zahntech* 2016; 42(6):740-765
- [5] Stawarczyk B, Özcan M: Abrasionsuntersuchungen mit verschiedenen Dentalwerkstoffen. Dental Materials Unit, Universität Zürich (2010). Publikation in Vorbereitung.
- [6] Stawarczyk B, Özcan M, Schmutz F, Trottmann A, Roos M, Hämmerle CH. Two-body wear of monolithic, veneered and glazed zirconia and their corresponding enamel antagonists. *Acta Odontol Scand.* 2013 Jan;71(1):102-12. doi: 10.3109/00016357.2011.654248. Epub 2012 Feb 27.

PRODUCT LIST

Product	Name	Company
CAD/CAM components	D900 scanner and S2 Impression milling unit	3Shape and vhf manufacture (distributed by Henry Schein)
Staining liquids	Colour Liquid Aquarell, Colour Liquid WaterBased	Zirkonzahn
Sintering furnace	HT-S Speed	Mihm Vogt
Rotating instruments, zirconia finishing	Complete set for zirconia "Zirkon Gesamtbearbeitungs-Set"	sirius ceramics
Veneering ceramics	GC Initial Zr-FS	GC Germany
Zirconia	Zirlux 16+	Henry Schein



22 At the end of the day, it is not just the shape but also the shade that counts. The Zirlux 16+ shade system allows the basic tooth shades to be generated very accurately and reproducibly.

CURRICULUM VITAE

Carsten Fischer has been an independent dental technician running his own laboratory in Frankfurt, Germany since 1996 and an internationally renowned speaker since 1994, supporting his activities by publications in several countries (Brazil, Argentina, Japan, Australia and Europe). Carsten Fischer is a member of several professional advisory boards and a long-time consultant for major players within the dental industry. His focus is on CAD/CAM, ceramic double crowns, custom abutments, and all-ceramic materials. From 2014 to 2014, Carsten Fischer was a part-time employee of the University of Frankfurt and continues to work together closely with it. In 2013, his presentation was voted best-in-class by the Association of Dental Technologies (ADT). The award-winning publications co-authored with Dr Peter Gehrke have met with considerable interest in the trade press; they are regarded as a yardstick for the evaluation of custom abutments. Carsten Fischer is a lecturer at Steinbeis University, Berlin, and a speaker for various organizations (DGI) and vice president of the EADT.



ZIRLUX® 16+

THE MOST COMPREHENSIVE ZIRCONA PORTFOLIO AVAILABLE

PRE-SHADED AND WHITE FOR PRODUCING ALL 16 VITA SHADES



The main features of 16+ at a glance:

- Pre-shaded in 16 VITA shades
- High translucency
- High strength at 1200 MPa
- Four blocks dimensions for InLab MC XL
- 40 x 19 x 15
- 55 x 19 x 15
- 65 x 25 x 22
- 85 x 40 x 22
- Circular blanks with Ø 98,5 mm and strengths 10, 12, 14, 16, 18, 20, 22 and 25 mm as well as Ø 100mm, Zirkozahn and Amann-Girrbach.
- More efficient workflow due to „Glaze&Go“

FIND MORE INFORMATION AT
WWW.ZIRLUX.COM OR CONTACT
YOUR LOCAL HENRY SCHEIN OFFICE.

 HENRY SCHEIN®
ConnectDental®

© Copyright 2016 Teamwork Media Fuchstal • © Co