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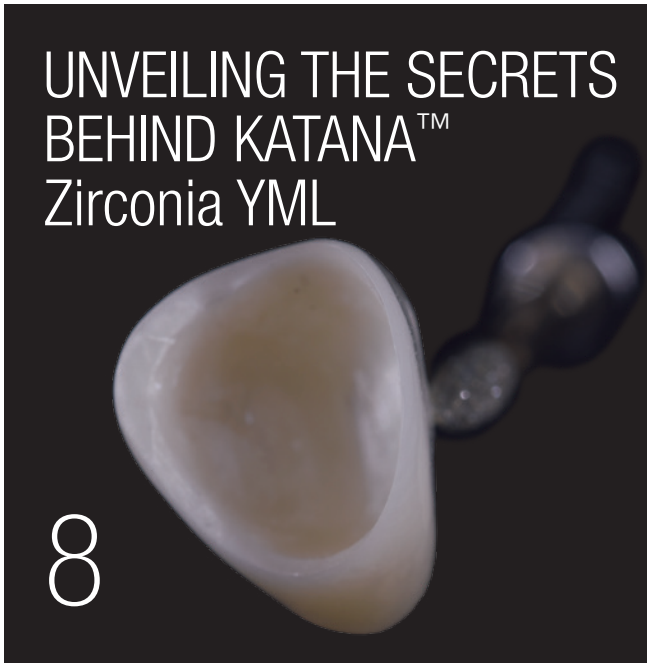
Image DT Marco Stoppaccioli – L'Aquila

Contents



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INNOVATION AND WORKFLOW SIMPLIFICATION MADE POSSIBLE

YUSUKE FUJIMURA
Head of Scientific Marketing Europe

Dear reader,

It is my pleasure to welcome you to Volume 8 of BOND, Kuraray Noritake Dental's newsletter for professionals in dentistry.

In this edition of BOND, we're shining a spotlight on the innovation and workflow simplification made possible by high-quality products like our "KATANA™ Zirconia" range.

Of particular note is an interview with Atsushi Matsumoto and Yuta Tajima from Kuraray Noritake Dental Inc.'s Research & Development Department in Japan, about the newest member of the "KATANA™ Zirconia" family: "KATANA™ Zirconia" YML (yttria multi-layered). These experts explain the benefits of this new material possessing different concentrations of yttria in a single blank, and highlight how its multi-layered nature allows practitioners to work with a nearly universal zirconia suitable for all cases.

Mathias Fernandez Lombardi, EU Scientific Manager Dental Ceramics & CAD/CAM Materials at Kuraray Europe, has contributed an excellent article detailing the science behind "KATANA™ Zirconia". From the raw material production through blank pressing and sintering, each step has been rigorously researched and optimised to deliver a highly aesthetic, mechanically strong range of products. For this volume of BOND, Fernandez Lombardi was kind enough to also speak about "KATANA™ Zirconia" YML and how it will positively impact dental laboratory workflows.

I am also excited to introduce Kuraray Noritake Dental's brand new 4.4.1. kit, an introductory set designed specifically for the "ZERO CUT-BACK" or "ULTRA-THIN LAYERING" technique used for multi-layer and translucent zirconia. The master dental technicians Enrico Ferrarelli and Daniele Rondoni have thus kindly provided case studies demonstrating how this kit can create a natural appearance and deliver a depth effect for monolithic restorations with fewer ceramic elements. As you'll see, our 4.4.1. kit can help achieve aesthetically superior outcomes in a predictable and flexible way.

Last, but certainly not least, is an article from Dr Stefano Daniele detailing his experiences with Kuraray Noritake Dental's KATANA™ Cleaner during bonding procedures for metal-free fixed dental prostheses. The Milan-based restorative dentistry practitioner emphasises the need for the ceramic and hard tissue bonding surfaces to be clean – something that can be quickly and easily achieved with the KATANA™ Cleaner without any adverse effects.

With my best regards,

Yusuke Fujimura,
Head of Scientific Marketing Europe

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KATANA™ Zirconia

THE SCIENCE BEHIND SUPERIOR PRODUCT PROPERTIES

Users of dental zirconia are really spoilt for choice these days. Countless manufacturers offer zirconia materials that differ in their mechanical and optical properties and indication range. What is not apparent at first sight is that the available products also differ with respect to the quality of the CAD/CAM blanks offered. Blank quality is highly dependent on the quality of the raw materials and is affected by different aspects during raw material processing, pressing and pre-sintering. This has a huge impact on the surface quality, edge stability, fit and processing requirements of milled restorations.

Raw material production

Pre-shaded dental zirconia typically consists of metal oxides, including zirconium oxide, yttrium oxide and aluminium oxide, as well as additives like binders and colour pigments or ions. Most manufacturers of dental zirconia obtain pre-fabricated powder from an external industry partner, the most popular option being Tosoh Corporation. In contrast, Kuraray Noritake Dental relies on an end-to-end in-house process. This includes the production and addition of the components forming the company's innovative multilayer technology for a polychromatic blank structure and – in the case of "KATANA™ Zirconia" YML – additional translucency and flexural strength gradation.

At Kuraray Noritake Dental, the powder is produced in-house.

Since more powder production steps are carried out in-house, the company is given full control over the quality of the raw materials, their grain size and the purity of the formulation. It also allows for a precise alignment of the mechanical and optical product properties to achieve a smooth transition from one layer to the next. The result is a seamless colour structure and outstanding match of the shades in the polychromatic blanks to the colours of the VITA classical A1–D4 shade guide. In those materials combining different yttria concentrations in a single blank, additional in-house alignment measures may be taken. In the case of "KATANA™ Zirconia" YML, a completely new raw material was developed to deliver a uniform shrinkage ratio and harmonized coefficients of thermal expansion across the blank und thus bring flexural strength gradation to perfection.

Properties of zirconia restorations that are affected by the powder quality and composition include translucency and shade appearance, flexural strength, ageing behaviour and sintering performance.

Blank pressing

Zirconia discs and blocks used for CAD/CAM processing are usually produced by uniaxial and isostatic pressing. In the uniaxial compaction process, pressure is applied to the powder from one direction (uniaxial) or two directions (biaxial), whereas the isostatic compaction process involves virtually equal pressure applied from all sides. Hence, isostatic pressing typically results in a more uniform density distribution throughout the blank and a higher material homogeneity. These factors are prerequisites for a predictable processing and sintering behaviour and affect the fit of the final restoration. For optimal mechanical and optical properties of the zirconia material, it is essential to avoid large porosities, air pockets and impurities caused by airborne particles that are trapped during pressing.

A "KATANA™ Zirconia" blank ready for milling.

Image: DT Giuliano Moustakis

At Kuraray Noritake Dental, a unique and extremely meticulous pressing process achieves a uniform pressure distribution and low risk of contamination by airborne particles. This specific procedure reduces gravitation forces and contributes to having as high as possible density of zirconia material. All the high-level preparation processes from raw material production to pressing are responsible for the high edge stability and surface quality of restorations milled from "KATANA™ Zirconia".

Pre-sintering

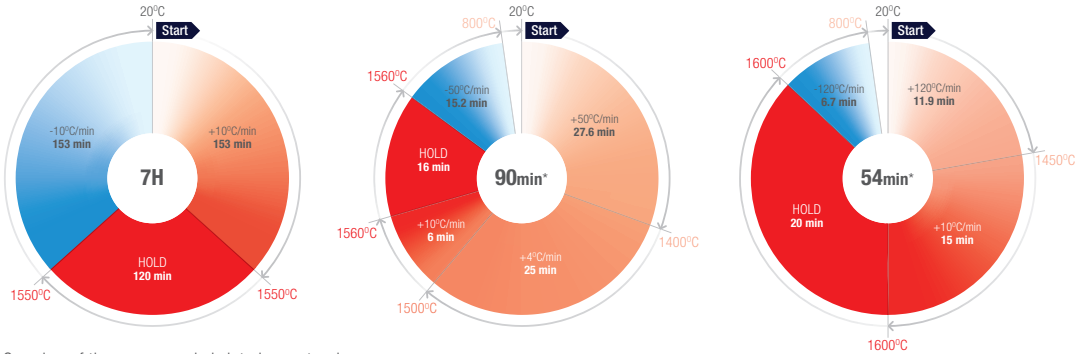
The pre-sintering procedure is necessary in that it gives the pressed blanks the required stability to be machinable with milling tools. The selected temperature profile and duration of the pre-sintering cycle determine the material's strength and processing properties and have an impact on the final sintering process.

The unique pre-sintering procedure carried out in the production facilities of Kuraray Noritake Dental results in blanks that are stable in their pre-sintered state. Although more stable, pre-sintered "KATANA™ Zirconia" is machinable with common diamond-coated milling tools without any increased risk of breakage or higher tool wear.

Fast sintering for the laboratory

The unique procedure has a positive impact on the surface smoothness after milling and can significantly shorten sintering times. In fact, the lab-side speed sintering program offered for all variants of "KATANA™ Zirconia" is the fastest one on the market, even for high aesthetic cubic materials. In the dental laboratory, the sintering times may be reduced to 54 minutes* for single-tooth restorations and bridges of up to three units – an interesting option for rush cases and remakes. Uniform sintering schedules are offered for the whole "KATANA™ Zirconia" Multi-Layered Series.

* The material is removed from the furnace at 800 °C.



Overview of the recommended sintering protocols.

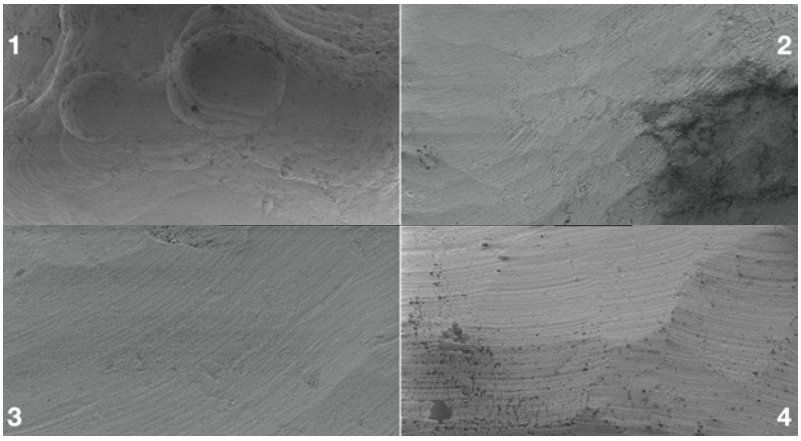
Fast sintering for chairside

Using the "KATANA™ Zirconia" block with Dentsply Sirona's CEREC system, it is possible to sinter single crowns up to three-unit bridges in 18–30 minutes without compromising the mechanical or optical properties.

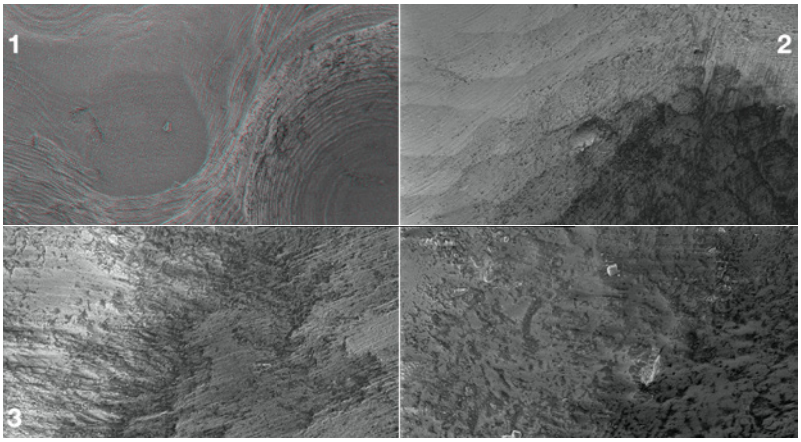
The "KATANA™ Zirconia" block displays superior optical properties after 18 minutes of sintering compared with representatives of major competitors' raw material after 30-minute and 60-minute sintering programs designed by Kuraray Noritake Dental based on the manufacturer's recommendations.

Unique "KATANA™ Zirconia" properties

Together, these efforts taken by Kuraray Noritake Dental to produce dental zirconia of high quality make all the difference. The "KATANA™ Zirconia" series -"KATANA™ Zirconia" Yttria Multi Layered (YML), Ultra Translucent Multi Layered (UTML), Super Translucent Multi Layered (STML), High Translucent Multi Layered Plus (HTML Plus) and "KATANA™ Zirconia" High Translucent Mono Layered (HT) - have a homogeneous, high-density structure with low porosity and a high level of purity. In addition, "KATANA™ Zirconia" YML offers a seamless structure without transition lines despite flexural strength gradation. All these properties optimise the performance of the blanks during machining.



KATANA™ Non Polished



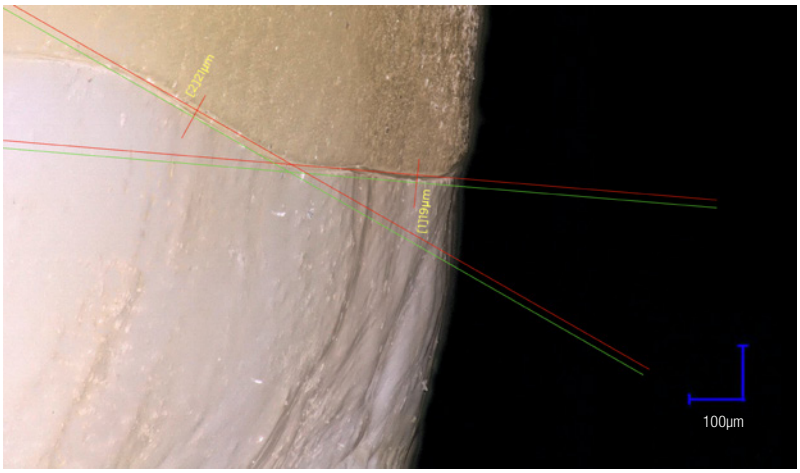
C - Non Polished

SEM images of non-polished "KATANA™ Zirconia" and a competitor's material at 33× magnification. The four images of each material show the surface structure at different areas of a molar crown. In all areas, the surface of the restoration made of the competitor's material is rougher and shows more porosity than the surface of the "KATANA™ Zirconia" crown directly after milling, according to Dr Josef Kunkela's research results. One of the contributing factors to this result is the more densely pressed blanks with smaller grain sizes of "KATANA™ Zirconia". (Courtesy of Kunkela Research Academy by Dr Josef Kunkela)

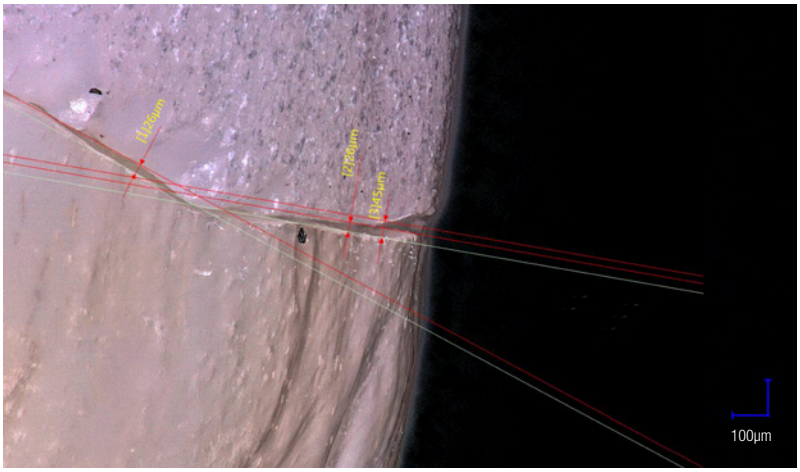
Surface roughness

An optimised processing behaviour leads to regular restoration margins, smooth surfaces and a precise fit of the restorations. The latter is due to the fact that the milling behaviour and volumetric shrinkage during final sintering are highly predictable, so that a user designing a 20 µm cement gap will get what he or she desires. Owing to the great control over optical properties and outstanding match to the VITA classical A1–D4 shades, "KATANA™ Zirconia" is considered to be one of the most aesthetic dental zirconia options available on the market.

Exellent marginal fit

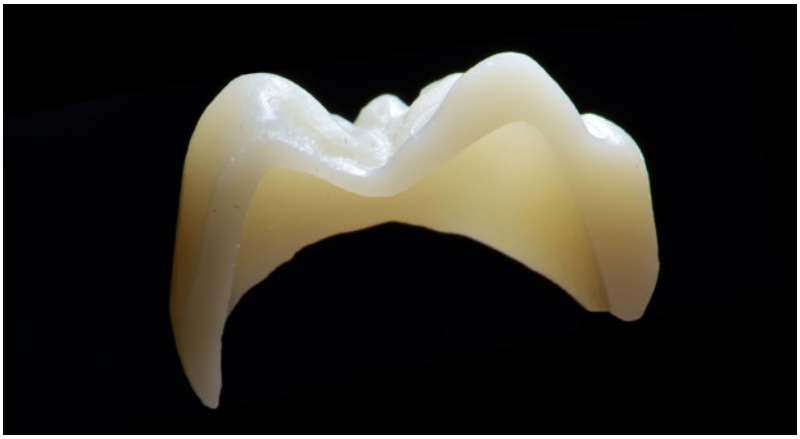


"KATANA Zirconia" STML Block / Primemill - 19-21µm



Lithium Disilicate / Primemill - 26-45µm

SEM images revealing the fit of restorations made of two different materials (lithium disilicate and "KATANA™ Zirconia" Block STML) on a tooth abutment. The "KATANA™ Zirconia" restoration shows a more regular margin and more precise fit (with a cement gap of 19–21 µm) than the lithium disilicate crown (cement gap 26–45 µm). (Courtesy of Kunkela Research Academy by Dr Josef Kunkela)



Extremely regular margins of a "KATANA™ Zirconia" crown after milling, which is also a result of the favourable material structure.

In order to ensure all the desired material properties, including aesthetics and strength, one thing is essential: the machining carried out in the dental laboratory – milling and sintering – needs to adhere to the recommended protocols. This means that the milling machine and furnace should be cleaned and calibrated on a regular basis, which provides the conditions for optimised zirconia processing from the powder to the final, true-to-life dental restoration.

Mathias Fernandez Y Lombardi
EU Scientific Manager

Dental Ceramics & CAD/CAM Materials
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2013: Successful completion of an apprenticeship as a dental technician at Seuthe dental laboratory in Plettenberg, Germany
2018: Successful completion of dental technology studies at the University of Osnabrück, Germany. Graduation as an engineer in dental technology.
Since March 2018: Employee of Kuraray Europe GmbH

MULTI-LAYERED ZIRCONIA REINVENTED:

UNVEILING THE SECRETS BEHIND "KATANA™ Zirconia" YML

The “KATANA™ Zirconia” family of multi-layered CAD/CAM blanks has a new member: “KATANA™ Zirconia” YML (yttria multi-layered). Based on Kuraray Noritake Dental Inc (KND). proprietary multi-layer technology, this new material offers multiple layers with different levels of chroma and translucency PLUS different concentrations of yttria in a single blank. We talked to two experts from Kuraray Noritake Dental’s Research & Development Department in Japan, Atsushi Matsumoto and Yuta Tajima, about the new product and its specific features.

Mr. Matsumoto, Mr. Tajima, KND already offers a broad range of zirconia materials covering virtually every indication. Why did you decide to start developing yet another dental zirconia?

The "KATANA™ Zirconia" series has indeed received high praise and great feedback from the market. Users particularly appreciate the remarkably high strength of HTML, the well-balanced aesthetic and strength properties of STML, and also the high translucency of UTML. Although there has been a large increase of zirconia materials in the dental market recently, we have received many requests from our customers for a more universal material that offers the excellent properties of all variants of "KATANA™ Zirconia" in one product. This product should allow them to fabricate all kinds of restorations from a single disc, from single crowns to full bridges, while maintaining high aesthetic and mechanical properties for both anterior and posterior restorations. As the developer of the "KATANA™ Zirconia" series, the invention of "KATANA™ Zirconia" YML is our response to these desires expressed by our customers.

What is the main difference between "KATANA™ Zirconia" YML and the other available products of the "KATANA™ Zirconia" Multi-Layered Series?

All layers of "KATANA™ Zirconia" UTML, STML and HTML are produced from the same basic powder composition and therefore offer the same strength throughout the whole blank. Depending on the case-specific requirements, users need to select the most suitable type of material, either a high-strength zirconia or a highly translucent variant. "KATANA™ Zirconia" YML is an all-in-one zirconia suitable for all cases: It consists of a high-translucency enamel layer, an intermediate layer offering well-balanced strength, translucency and colour, and a high-strength body layer. The raw materials used for this product are developed and produced by KND exclusively for YML. This is another milestone in advanced product development "KATANA™ Zirconia".

We have received many requests from our customers for a more universal material.

"KATANA™ Zirconia" YML is an all-in-one zirconia suitable for all cases.

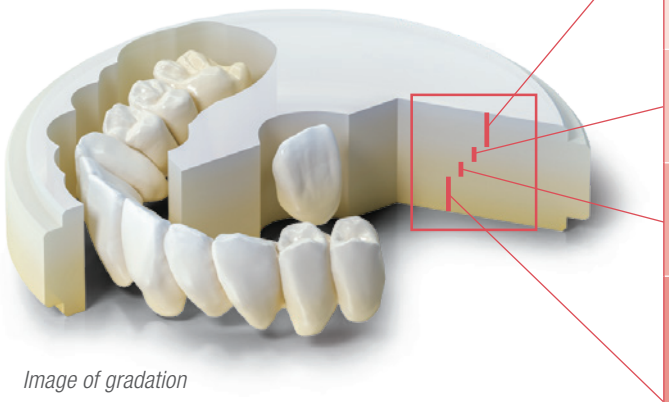
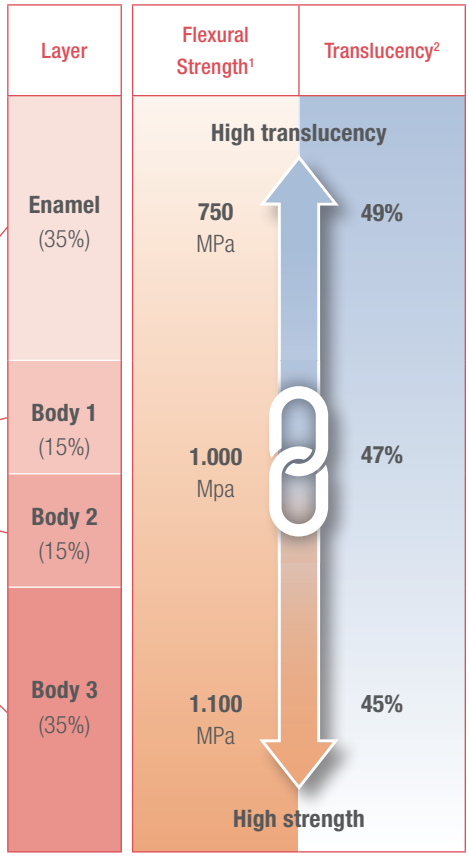


Image of gradation



(..%) the thickness of each layer in a disc in %

Measurement condition: evaluated by base material (white color).
1 According to ISO 6872: 2015, Sample size: 3 x 4 x 40 mm,
2 All light transmittance, illuminant: D65, Thickness of sample: 1.0 mm

Data source: Kuraray Noritake Dental Inc. The numerical value varies according to a condition.

In general, the currently available zirconia materials with an integrated strength gradient do not have a very positive image in the eyes of many dental technicians and specialists, due to the fact that in the incisal area, the materials seem to be insufficiently strengthened. This can lead to fractures when it comes to long-span restorations, especially if they are inadequately positioned within the blank. How carefully did KND focus on these problems and how did they try to solve them in order to stand out from the competition?

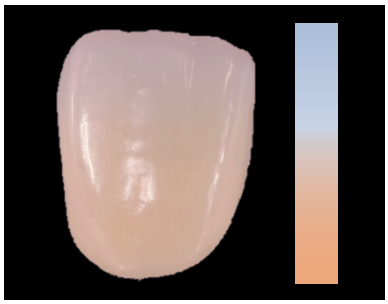
The current yttria-based multi-layer products on the market are facing complicated limitations in connector position in large cases, such as full-arch restorations, due to the lack of an ideal combination of aesthetics and strength. To overcome this challenge, KND developed well-balanced raw materials of high strength and high aesthetics, and by including these raw materials in the intermediate layer between the enamel and body layers. The result is that even for long-span restorations, it is very simple to position the connectors thanks to its excellent balance between high strength and high aesthetic properties. Due to these unique attributes incorporated in our new product, the risk of deformation and breakage is avoided.

Another problem is the often clearly visible line between the different layers containing different amounts of yttrium oxide, which can be seen at a more detailed inspection after sintering. How did you address this issue?

At KND, we achieved both, adequate translucency gradation and invisible transition lines, even for zirconia layers with different yttria content. This has been accomplished thanks to our multi-layer zirconia manufacturing technology refined over many years, which includes mixing the appropriate amount of each layer's boundary to intentionally avoid transition lines. In addition, the newly developed interlayer raw materials and a newly designed sintering schedule were the keys to success.

How is it possible to have a sintering protocol that works for different zirconia components within the "KATANA™ Zirconia" YML blank and allows for the shortest sintering times ever?

The amount of shrinkage during sintering is determined by different factors such as the number and quantity of additives (yttria, alumina etc.) it contains. If the shrinkage ratio of each layer is different, transition lines are likely to appear between the layers, which might produce tensions in the material structure. The newly developed raw material for "KATANA™ Zirconia" YML enables us to control and unify the shrinkage ratio for all layers, even for raw materials with different yttria contents.



Enamel Layer
To provide high translucency that harmonizes with the anterior teeth.

Body Layer 1
To provide seamless color and translucency towards the Enamel Layer.

Body Layer 2, 3
To provide deep and vivid color while reducing whitening.

The use of proprietary raw materials produced in-house with excellent properties suitable for high-speed sintering was the main precondition that allowed for the development KND's high-speed sintering schedule (54 min for restorations up to 3-unit bridges), which is available for all products of the "KATANA™ Zirconia" multi-layered series. This option improves the efficiency of the dental technician's work and simplifies the workflow.

Are there any differences in milling and adjusting "KATANA™ Zirconia" YML compared to competitor products?

All "KATANA™ Zirconia" products from KND have an appropriate hardness with less chipping during the milling process thanks to the raw materials manufactured and refined in-house. Also, after the sintering procedure, it offers excellent chipping resistance, especially during very challenging marginal adjustments.

Is there anything else that sets "KATANA™ Zirconia" YML apart from other products with an integrated strength gradient?

Yes, "KATANA™ Zirconia" YML offers reduced sintering deformation, thanks to in-house developed raw materials, based on proprietary technology to control shrinkage rate. Moreover, we offer a wide range of shades (14), which is another important aspect (apart from the material's well-balanced aesthetic properties and absence of transition lines) for the creation of lifelike restorations. Finally, since three out of four layers meet the conditions for an ISO class 5 classification, there are few restrictions on the design variation of the prosthesis.

Why should a dental technician consider using "KATANA™ Zirconia" YML instead of any other dental zirconia (in your opinion)?

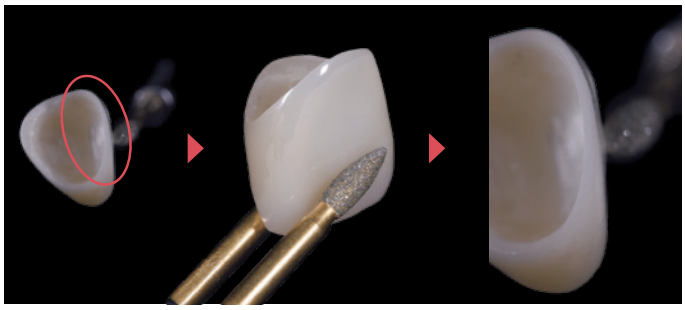
Atsushi Matsumoto:
It is now possible for dental technicians to produce strong and aesthetic restorations with just one material, "KATANA™ Zirconia" YML. This allows for a reduced inventory, while working time is significantly shortened due to the possibility of high-speed sintering.

Yuta Tajima:
To my mind, the most convincing properties are excellent firing accuracy due to well-balanced material properties across all layers, the wide range of shades available and the great design flexibility even when designing long-span bridges. Last but not least, the trusted quality of the KATANA™ brand and the label "Made in Japan" are reasons to opt for this new product.

All blanks from the "KATANA™ Zirconia" Series stand out from other dental zirconia materials due to their particularly fine-grained, densely pressed microstructure, which is the basis for a superior surface quality, edge stability and the resulting accuracy of fit. What is the secret behind this exceptionally high blank quality?

Since we do not know the correlation between marginal stability properties (chipping, etc.) and material compositions, structures etc., it is very difficult to answer

We are using pigments developed by KND, which have an excellent colour stability without fading even after the final sintering procedure.



Even if the restoration margins have been milled to a very thin profile, they still show smooth margins without any chipping.

this question. It may depend on the structures of the zirconia crystals, the raw material itself, the correct strength level after pre-sintering or any other minor factor during the manufacturing process of the disc. All these factors together, of course, are important.

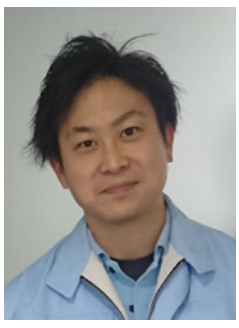
A clear advantage of the "KATANA™ Zirconia" series, much praised by KND's Key Opinion Leaders, is its colour stability and shade match to the "VITA classical shade guide". Can you explain the importance of an in-house conducted addition of additives and color pigments in form of metal oxides to satisfy the user and distinguish "KATANA™ Zirconia" from competitors' products?

We are using pigments developed by KND, which have an excellent colour stability without fading even after the final sintering procedure. The particle size is appropriately controlled. In addition, our professional "colour mixing" staff, reflecting the opinions of clinically experienced dental technicians both inside and outside the company, have achieved a pigment mixture that shows only a slight change in shade even in cases with different thicknesses.

What is your vision with regard to future developments in dental zirconia?

Since the introduction of zirconia on the dental market, many significant material advances have been achieved. Today, there are high-strength, low light-transmitting zirconia materials up to high light-transmitting, low strength zirconia materials available on the market. Furthermore, there are now also high light-transmitting, low strength zirconia materials in mixed systems (YML series) offered. Our foremost goal is to develop the ultimate zirconia in near future, combining both high strength and high light transmission, which breaks the general expectation of a compromise between strength and translucency within zirconia materials.

Atsushi Matsumoto



Yuta Tajima

MDT DANIELE RONDONI AND DR. ENZO ATTANASIO

TREATMENT OF A YOUNG PATIENT WITH ZIRCONIA VENEERS

Veneers made of zirconia? In some cases, like the one presented below, monolithic zirconia veneers may be an option. Reasons for selecting a latest-generation zirconia such as “KATANA™ Zirconia” YML include its very high translucency and a wall thickness of only 0.3 to 0.4 mm supporting minimally invasive tooth preparation. Due to a highly automated production procedure, the manual effort involved may be reduced, while highly aesthetic outcomes are possible.

MDT **Daniele Rondoni**

Dr. **Enzo Attanasio**

Fig. 1: Initial situation: Young female patient with misshaped and misaligned maxillary incisors.

Fig. 2: Digital smile design revealing the ideal proportions and positions of the anterior teeth.

Fig. 3: Ideal tooth proportions and positions displayed over a picture of the teeth after orthodontic treatment and the creation of a mock-up. The positions are ideal and the tooth shapes obtained with the mock-up only need some minor adjustments.

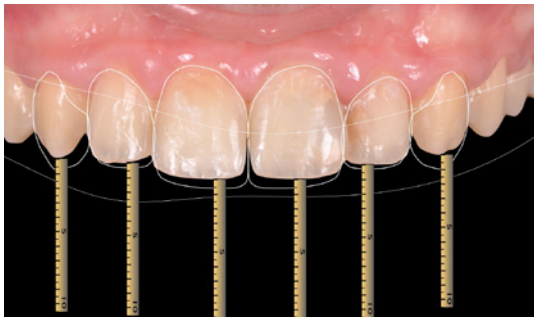


Fig. 4: Detailed view of the maxillary teeth with the ideal shapes blended in. The decision is made to produce six veneers made of "KATANA™ Zirconia" YML for definitive treatment.

Fig. 5a: Digital impression of the maxillary teeth with mock-up imported into the design software.

Fig. 5b: Digital model of the maxilla in the CAD software with full-contour veneers designed for the incisors and canines according to the ideal shapes planned with digital smile design.

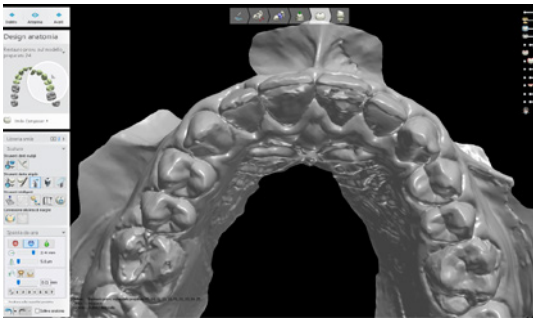


Fig. 6a: Occlusal view of the virtual model.

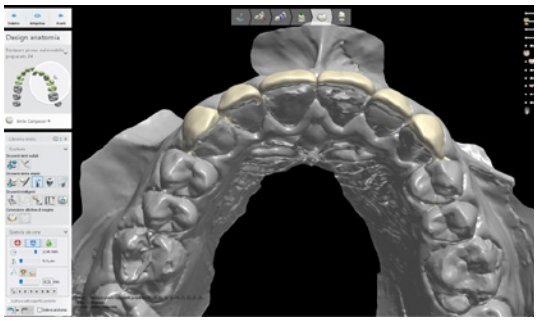


Fig. 6b: Occlusal view of the model with the designed veneers.

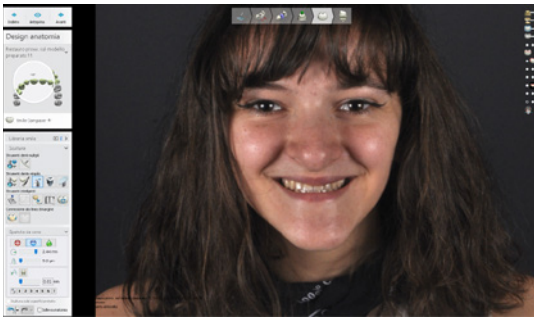


Fig. 7a: Facial view of the patient with the mock-up in place.

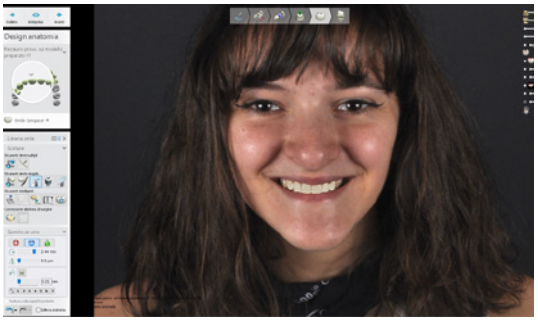


Fig. 7b: Facial view of the patient with the planned veneers blended in.

Fig. 8: Guided tooth structure removal with the aid of a silicone index. The minimum wall thickness of the selected material – "KATANA™ Zirconia" YML – is 0.4 mm.

Fig. 9: Maxillary teeth immediately after minimally-invasive tooth preparation.

Fig. 10: Matched digital impressions of the maxilla and mandible taken after the tooth preparation.

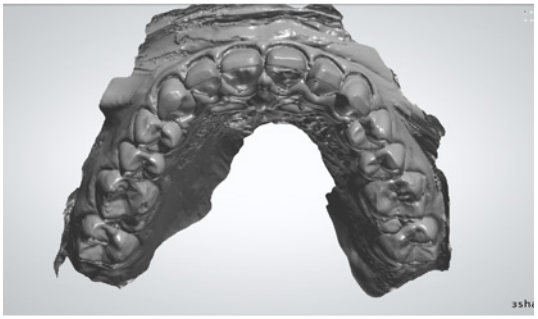


Fig. 11: Digital impression: occlusal view of the maxillary teeth.

Fig. 12: Virtual veneers ready to be milled.

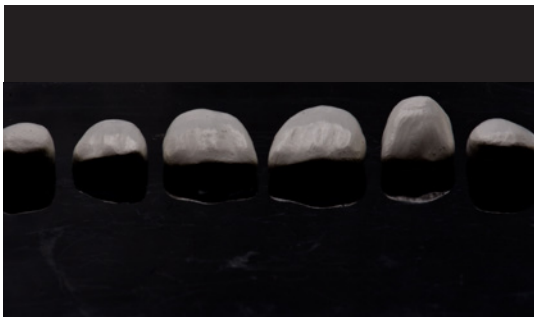


Fig. 13: Pre-sintered veneers made of "KATANA™ Zirconia" YML.

Fig. 14: Zirconia veneers on the resin model after sintering.

Fig. 15: Monolithic zirconia restorations on the resin model after the 7-hour final sintering.

Fig. 16: Frontal view of the master cast with the six veneers individualized with the liquid ceramic system CERABIEN™ FC Paste Stain.

Fig. 17: Lateral view of the veneers on the master cast.

Fig. 18: Tooth-like translucency of the veneers on the model.

Fig. 19: The minimal wall thickness of 0.4 to 0.6 mm and the positioning of the veneers in the upper (enamel) part of the blank are responsible for this effect.

Fig. 20: Veneers made of "KATANA™ Zirconia" YML ready for try-in.

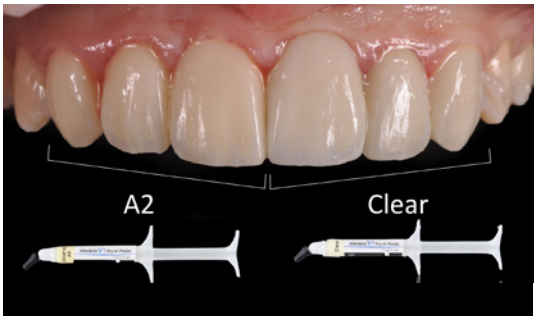


Fig. 21: Intra-oral try-in with two different shades of the "PANAVIA™ V5" Try-in Paste: A2 is used in the right and Clear in the left quadrant.

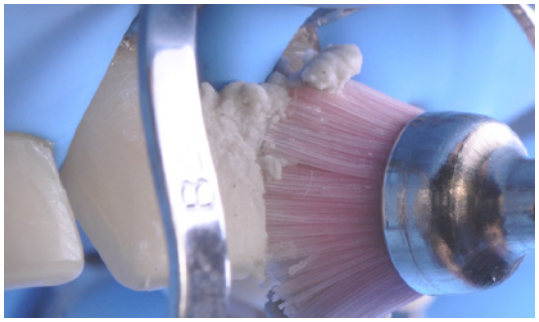


Fig. 22: Cleaning of the tooth structure with pumice paste after try-in.

Fig. 23: Thorough rinsing with water to remove any paste residues.

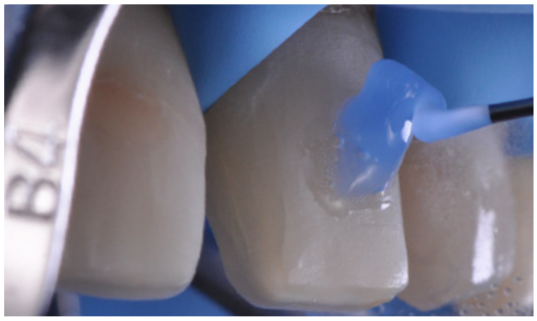


Fig. 24: Etching of the prepared tooth structure with phosphoric acid etchant.

Fig. 25: Clean, isolated central incisors ready for adhesive cementation.

Fig. 26: Sandblasting of the veneer's intaglio with alumina oxide (particle size: 50 µm, pressure: 2 bar). This kind of surface conditioning treatment is recommended for zirconia, as it creates the desired micro-retentive surface structure favourable for adhesive bonding[1].

Fig. 27: Application of "CLEARFIL™ CERAMIC PRIMER" PLUS to the bonding surface of the veneers (followed by mild air-drying).

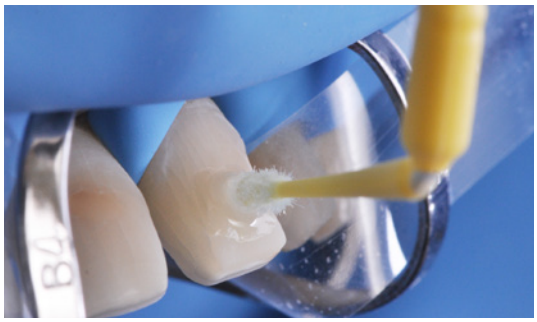


Fig. 28: Treatment of the etched tooth structure with "PANAVIA™ V5" Tooth Primer (followed by mild air-drying).

Fig. 29: Application of "PANAVIA™ V5" Paste (shade A2) to the bonding surface of the veneers.

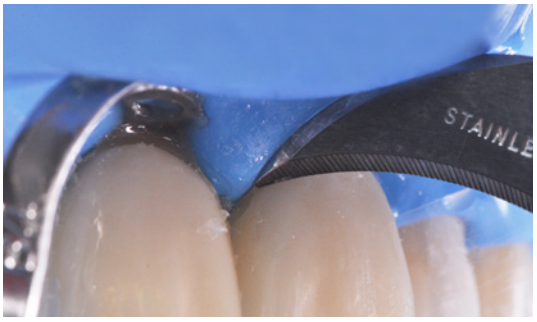


Fig.30: Close-up view of the restoration margin during cementation. Working field isolation is a key success factor of adhesive procedures.

Fig. 31: Lateral view of the cemented veneers. The result is a natural surface texture, which contributes to a natural appearance of the restorations.

Fig. 32: Frontal view of the veneers in place.

Fig. 33: Treatment outcome immediately after rubber dam removal.

Fig. 34: Treatment outcome with healthy soft tissues two weeks after treatment.

Fig. 35: Gums are healthy and the restorations show a great optical integration with the adjacent posterior teeth.

References

[1] Nishigawa G, Maruo Y, Irie M, Maeda N, Yoshihara K, Nagaoka N, Matsumoto T, Minagi S. Various Effects of Sandblasting of Dental Restorative Materials. PLoS One. 2016 Jan 14;11(1):e0147077.

EMPOWER YOUR DENTAL LAB

"KATANA™ Zirconia" YML

Kuraray Noritake Dental Inc. reinvented its original zirconia multi-layer technology by integrating newly developed raw materials with different yttria content into the proven multi-layer colour structure. The material that is based on this innovative technology, “KATANA™ Zirconia” YML, offers a well-balanced flexural strength, chroma and translucency gradation throughout the blank.

According to pilot users of the new zirconia discs, the greatest benefit of using "KATANA™ Zirconia" YML is in the true empowerment of the laboratory. We asked Kuraray Noritake’s EU Scientific Manager Dental Ceramics & CAD/CAM Materials, Mathias Fernandez Lombardi, to explain how the new material is able to positively affect work routines in the dental laboratory.

The greatest benefit of using "KATANA™ Zirconia" YML is in the true empowerment of the laboratory.

Mathias Fernandez Lombardi, who should consider working with "KATANA™ Zirconia" YML?

"KATANA™ Zirconia" YML is designed for laboratories and milling centres with a strong focus on simplification. With its strong body and highly translucent enamel layer, it offers exactly the properties required for an unlimited indication range. Being perfectly suited for the production of durable monolithic long-span posterior bridges and of highly aesthetic anterior crowns or partial restorations, "KATANA™ Zirconia" YML is a true all-rounder that eliminates the need for another zirconia or even ceramic CAD/CAM material. At the same time, it supports highly automated production procedures and requires minimal hand work.

What are the benefits of using a single material for every indication?

Several benefits are related to the use of a single, all-round material. It leads to a reduced number of blanks to be stored, which simplifies inventory management and minimizes the storage space needed. Moreover, it facilitates standardization of laboratory workflows. Using the same material every time means that there are no differences in the basic design and milling parameters like minimum wall thicknesses and connector strengths, in the sintering protocols and finishing options to be taken into account. Hence, errors are less likely to occur and routines are easily established. Finally, the risk of cross-contamination is eliminated when a single material is processed with the available equipment (milling machine, milling and finishing tools, and sintering furnace). Predictable outcomes and flawless aesthetics are usually the result.

What are the benefits related to the use of "KATANA™ Zirconia" YML as the only ceramic CAD/CAM material?

I guess that the most important argument is that aesthetic outcomes are easily and efficiently achieved with "KATANA™ Zirconia" YML for all kinds of restorations, even for long-span bridges. It is usually sufficient to produce monolithic restorations for the posterior region, which are just polished or glazed. Anterior restorations may be designed monolithically

or with minimal cut-back, and the user may choose between "CERABIEN™ ZR" (CZR) FC Paste Stains and CZR Internal Stains plus glaze to obtain a natural look. Another benefit of "KATANA™ Zirconia" YML is its seamless multi-layer structure combined with an extraordinary blank quality.

Aesthetic outcomes are easily and efficiently achieved with "KATANA™ Zirconia" YML for all kinds of restorations, even for long-span bridges.

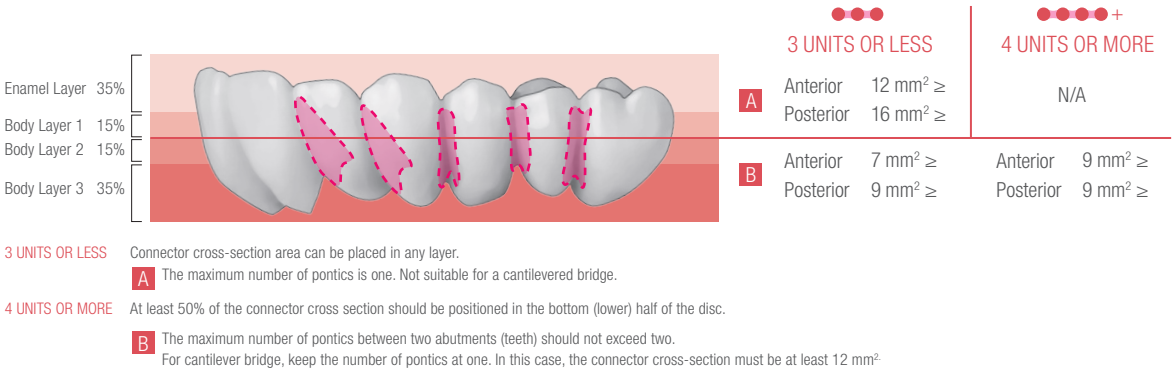
Why is this seamless structure and high blank quality important for users?

The seamless multi-layer structure, that is a smooth transition from one layer to the next, is the precondition for structural integrity and flawless aesthetics. It ensures that the material is free of transition lines, offers accurate dimensions after sintering (due to uniform shrinkage) and shows a reliable long-term performance not compromised by internal tensions. In "KATANA™ Zirconia" YML, a completely homogeneous composition, with carefully aligned CTE-values and shrinkage ratios in all parts of the blank, is responsible for this benefit. For its development, Kuraray Noritake Dental leveraged its long-standing expertise in dental ceramics and the advantages of an end-to-end in-house blank production process, without which it would have been impossible to reach the requested quality level. Due to the fact that the material is so well aligned, it was even possible to develop a 54-minute sintering programme that produces equally good results as the proven 90-minute or 7-hour programmes and becomes the go-to option for all rush cases. With this feature, "KATANA™ Zirconia" YML becomes the “jack of all trades” material: It offers highest comfort and security like an SUV, but when it comes to speed, it is in no way inferior to a sports car.

	Temp.1	Rate of Temp. Increase °C/°F min	Temp.2	Rate of Temp. Increase °C/°F min	Temp.3	Rate of Temp. Increase °C/°F min	Temp.4	Hold Time	Rate of Temp. Decrease °C/°F min	Temp.5
54-minute	Room Temp.	120°C/216°F	1450°C/2642°F	10°C/18°F	1600°C/2912°F	–	–	20 min.	-120°C/216°F	800°C/1472°F
90-minute	Room Temp.	50°C/90°F	1400°C/2552°F	4°C/7°F	1500°C/2732°F	10°C/18°F	1560°C/2840°F	16 min.	-50°C/90°F	800°C/1472°F
7-hour	Room Temp.	10°C/18°F	1550°C/2822°F	–	–	–	–	2-hour	-10°C/18°F	RT.

The above sintering recommendations represent only a guideline; depending on each individual furnace and condition, some adjustments might be necessary.
If the 54 or 90-minute sintering program is not programmable in your furnace, it is not possible to set the furnace according to one of these schedules.
*The material is removed from the furnace at 800°C. A furnace with a configurable YML sintering program is required.

RELATION BETWEEN SETTING POSITION AND CROSS-SECTION



3 UNITS OR LESS Connector cross-section area can be placed in any layer.

A The maximum number of pontics is one. Not suitable for a cantilevered bridge.

4 UNITS OR MORE At least 50% of the connector cross section should be positioned in the bottom (lower) half of the disc.

B The maximum number of pontics between two abutments (teeth) should not exceed two.
For cantilever bridge, keep the number of pontics at one. In this case, the connector cross-section must be at least 12 mm².

Positioning of long-span restorations in the middle of the disc.

Users who have already tested ceramic materials with a strength gradient know that positioning of long-span restorations in the blank can be tricky. What are the rules to be respected when positioning a long-span bridge in a YML blank?

Positioning of restorations in "KATANA™ Zirconia" YML discs is extraordinarily easy. The reason is that the gap between the lowest flexural strength found in the enamel area and the highest flexural strength found in the lowest body layer is comparatively small. Moreover, the Body Layer 1 that is found adjacent to the enamel layer already offers a flexural strength that is higher than the 800 MPa requested for bridges with four or more units. Consequently, users are on the safe side whenever they place their long-span restorations in the middle of the blank. More specifically, half of the connector cross section needs to be in the lower half of the disc, which is quite different from other materials with strength gradation that allow for connector positioning in the body area only. "KATANA™ Zirconia" YML restorations with a maximum of three units may be positioned in any layer. In this context, the fact that the thickness of each layer increases proportionally with the height of the disc comes as a benefit: The enamel layer is large enough to exploit its aesthetic potential in single-unit or small bridge cases.

What would you recommend dental technicians who would like to empower their laboratory or milling centre?

I can truly recommend testing "KATANA™ Zirconia" YML in the laboratory environment to see how it handles and to assess its potential. The exceptional blank quality and seamless integration of the different layers, the ease of positioning and processing efficiency are factors potential users need to experience in real life to understand what they mean for their daily work. Similarly, the aesthetic outcomes need to be assessed in the clinical environment for an authentic impression of the natural look and feel obtained. I am sure that "KATANA™ Zirconia" YML will be able to convince virtually everyone who wants to empower the laboratory with an easy-to-use, efficient universal zirconia solution that fits virtually every patient's and every dentist's needs! Kuraray Noritake Dental knows that dental technicians and practitioners are in need of products that support their striving for simplification, standardization and increased efficiency so urgently needed in present times. Therefore, our product innovations are all focused on delivering more performance with less effort. "KATANA™ Zirconia" YML is the latest addition to a whole series of materials pursuing this goal.

GUIDELINE OF CONNECTOR CROSS-SECTION

Please observe the following guidelines of applicable cross-section wall thickness:

LOCATION & INDICATION	CONNECTOR CROSS SECTION*
Anterior 2-3 units	7 mm² or more
Anterior 4 units or more	9 mm² or more
Posterior 2-3 units	9 mm² or more
Posterior 4 units or more	9 mm² or more

Minimum size if more than half of the cross-section areas are in the bottom half of disc (up to 50% height from the bottom [lower]).

Minimum connector cross-sections are to be respected during the computer-aided design of "KATANA™ Zirconia" YML restorations.

Mathias Fernandez Y Lombardi
EU Scientific Manager Dental Ceramics & CAD/CAM Materials Kuraray Europe GmbH
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HOW TO MAXIMISE THE FULL POTENTIAL OF MULTI-LAYERED ZIRCONIA

The use of highly translucent, gradient pre-shaded zirconia brings more efficiency into the dental laboratory. Due to the advanced properties of the materials, e.g. from the “KATANA™ Zirconia” Multi-layered Series, true-to-life restorations may be created without any or with only a small vestibular layer of veneering porcelain. This saves a lot of time usually required for manual work around steps in the veneering of zirconia frameworks. At the same time, this also allows for a reduced wall thickness, beneficial in the context of minimally invasive dentistry.

In order to leverage the high aesthetic potential and balanced mechanical properties of these types of zirconia, however, it is essential that the restorations are processed under ideal conditions. The most advanced materials with the highest translucency are particularly sensitive to contamination during and after wet milling, contamination of the furnace chamber, and temperature variations during sintering. Possible undesirable effects include a grayish appearance of the restorations and low chroma, green, yellow, blue or gray traces in the restorations, white spots on the surface and variations in colour and translucency.

If carried out on a regular basis, the following measures will effectively eliminate these effects. Hence, they will support users in ensuring consistently beautiful results.

Optimizing the milling process

Blue or gray traces visible in the final restoration are usually the result of contamination of the cooling water with extrinsic particles in the context of wet milling, (which is usually conducted in chairside procedures). In most cases, silica particles left over from the processing of glass or silicate ceramics with the same milling unit are the root of the problem. The effect is easily avoided by thorough cleaning of the milling chamber, the water tank and the filter insert of the milling machine every time a different material needs to be processed. Another solution is dry instead of wet milling, which offers additional benefits such as shorter processing time and better quality edges and surfaces.

Decontamination of the furnace chamber

In general, the chamber of the sintering furnace should be cleaned before sintering. Important measures include the removal of dust inside the sintering chamber and cleaning of the heating elements, both done with a soft brush. The use of compressed air is contraindicated.

Unwanted optical effects that occur on restorations due to contamination of the sintering chamber include white spots on the restoration surface, a blue-grayish appearance and low chroma, as well as,green or yellow traces in the material. White spots on a restoration surface are usually indicators of contaminated alumina sintering beads or the use of the wrong instruments for surface modification

Blue or gray traces visible in the final restoration are usually the result of contamination of the cooling water.

White spots on a restoration surface are usually indicators of contaminated alumina sintering beads.

and sprue removal. These effects are avoidable through a monthly or even more frequent replacement of the sintering beads (as soon as they show any signs of discoloration) as well as the exclusive use of fine-grid diamond instruments for adjustments prior to sintering.

Alumina sintering beads may be the cause of white spots on a restoration surface if not replaced on a regular basis.

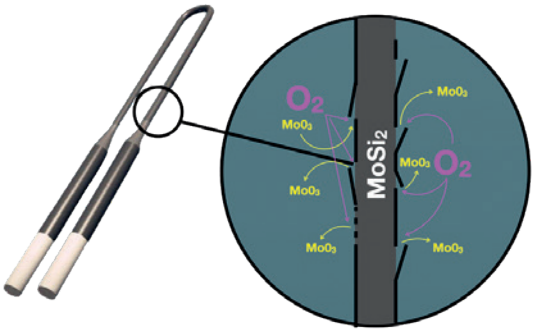
The blueish gray appearance and low chroma may be attributed to mineral residues from dipping liquids in the chamber. They are effectively removed by selecting the decontamination program in the furnace menu, which is run after inserting several residual pieces of a highly translucent, white zirconia blank. As soon as the decontamination cycle is completed, the chromatic intensity of the residual blank parts indicates whether a second cycle is required. In order to prevent the occurrence of a blueish gray appearance in new restorations, it is recommended to perform a decontamination program at least once per month.

Pieces of a white zirconia blank left over after milling.

$MoSi_2$ heating elements: Regeneration needed

If a restoration appears to be green or yellowish, it is most likely that the furnace is equipped with aging molybdenum disilicide ($MoSi_2$) heating elements in need of regeneration or replacement. The inner part of the elements is made of molybdenum (Mo), which is usually covered by a protective layer of silica ($MoSi_2$). This layer is naturally built up during sintering at a temperature range between 1,000 and 1,600 °C. As the thickness of the layer grows, its intrinsic residual compressive stress increases. This stress, as well as possible extrinsic influences, e.g. originating from acidic dipping liquids, may finally lead to cracks and a breakup of the protective layer. Once damaged, the molybdenum core is exposed. At a low temperature range of 400 to 600 °C, the molybdenum reacts with oxygen in the sintering chamber, a process referred to as pest oxidation. The resulting molybdenum oxide (MoO_3), together with ions or metal oxides from colouring agents, is responsible for the greenish yellow discoloration on the surface of the restorations.

Restorations displaying greenish yellow surface pigmentation.



Molybdenum disilicide heating element with a protective silica layer bursting off, leading to pest oxidation and the contamination of elements in the sintering chamber.

Regeneration firing, which involves a rapid heating rate and a long firing phase at approx. 1,450 °C, aims at regenerating the layer of silica. This measure, however, works only for a limited number of times, as a repeated process of pest oxidation and regeneration leads to aging of the heating elements. Hence, it will ultimately need to be replaced. The whole issue of pest oxidation may be effectively avoided by using a furnace with silicon carbide heating elements, which are highly aging-resistant and do not cause any discoloration. A positive side effect is that these types of heating elements deliver more constant temperatures.

Temperature control

Variations in translucency or chroma and pigmentation of restoration surfaces are often due to deviations in actual sintering temperatures from the recommended temperature curve. The only way to solve this issue is temperature calibration. This measure is not only a prerequisite for aesthetic results, but also has a decisive impact on the mechanical properties of the restorations: if the maximum temperatures are too high, for example, the flexural strength of the zirconia materials may be expected to decrease[1].

Effect of temperature differences during sintering on restorations made of "KATANA™ Zirconia" UTML: The restorations were sintered at the same nominal temperatures in three different furnaces!

Temperature control is usually carried out with the aid of TempTABs or PTCRs (process temperature control rings). They are placed into the furnace on a sintering tray and typically processed by running a calibration cycle. After sintering, the tab or ring diameter is determined. As TempTABs and PCTRs exhibit controlled shrinkage, it is possible to calculate the actual sintering temperature based on the measured diameter. A conversion table supports the user in determining the deviation between the temperature actually reached and the temperature displayed on the furnace. Subsequently, the values displayed on the furnace are adjusted if necessary.

TempTAB on a sintering tray with restorations ready for sintering.

General recommendations

In order to set the stage for brilliant aesthetics and ideal properties of zirconia restorations, it is essential to ensure optimal processing conditions. Instead of troubleshooting carried out whenever discoloration appears after sintering, it is advisable to take the following actions on a regular basis as preventive measures:

- Cleaning of the milling machine's water tank each time before milling (wet milling only)
- Strict adherence to the sintering protocols recommended by the material manufacturer
- Removal of dust from the sintering chamber and heating elements with a soft brush before each use
- Replacement of the alumina sintering beads whenever they show signs of discoloration (at least once per month)
- Exclusive use of fine-grid diamond instruments for sprue-removal and pre-sintering adjustments
- If possible: Use of furnace with silicon carbide heating elements
- Furnaces with molybdenum disilicide heating elements require constant visual control and regular regeneration cycles
- Running a decontamination program with decontaminating powder or white zirconia residues (y-TZP) at least once per month
- Temperature control and calibration at least once per month

With these simple measures, it is possible to maximise the full potential of "KATANA™ Zirconia" Multi-layered Series from Kuraray Noritake Dental.

References
1 Stawarczyk, B., Özcan, M., Hallmann, L. et al. The effect of zirconia sintering temperature on flexural strength, grain size, and contrast ratio. Clin Oral Invest 17, 269–274 (2013).

MINIMAL CERAMIC LAYERING ON A "KATANA™ Zirconia" MULTI-LAYERED MICRO-CUTBACK RESTORATION

By MDT Daniele Rondoni

This clinical report reveals why you should start:

- using fewer ceramic elements
- choosing minimal ceramic layering
- opting for micro-cutback solutions

without missing the quality and value of your restorations.

Advances in materials development and computer-aided processing allow for more streamlined workflows and an improved collaboration between the dental office and laboratory. In order to benefit from the new options, however, it is important that dental technicians embrace their new responsibilities: they need to keep track of the latest changes and need to acquire profound knowledge of how to leverage the materials' and technologies' full potential. Being open for new approaches and restoration techniques is part of this game. In return for their efforts, they will be able to achieve unparalleled aesthetic accuracy in a more efficient procedure.

The evolution of dental zirconia is an excellent example for advances in the field of dental materials: many modern zirconia discs have multi-layered structures and natural tranlucencies. Offering top-level performance and high versatility, these variants are increasingly often the materials of choice for the production of high-quality restorations.

The "KATANA™ Zirconia" multi-layered series, for example, is composed of three multi-layered materials: "KATANA™ Zirconia" HTML with the highest flexural strength (1,200 MPa) and lowest translucency, "KATANA™ Zirconia" STML with medium strength (750 MPa) and a high translucency, and "KATANA™ Zirconia" UTML with a strength above the level of glass ceramics (550 MPa) and ultra-high translucency. With this portfolio, it is possible to select the right material for every specific need (e.g., high-strength variant for multi-unit restorations, high-translucency variant for anterior crowns). Using the zirconia with a monolithic or minimal vestibular cut-back design and a small layer of porcelain enables us to reduce the wall thickness of the restorations (as compared to a traditional framework design and full porcelain layer). As a consequence, a less invasive tooth preparation is required.

In addition, the design meets the functional needs in terms of low abrasiveness and high toughness, while a sophisticated aesthetic outcome is achieved using micro-layering with the materials contained in the 4.4.1. kit. These can be a winning alternative to traditional ceramic multi-layer solutions, as revealed using the following case example that illustrates the use of the 4.1. technique.

Fig. 1: Digital impression.

Fig. 2: Digital impression taken with the temporary in place.

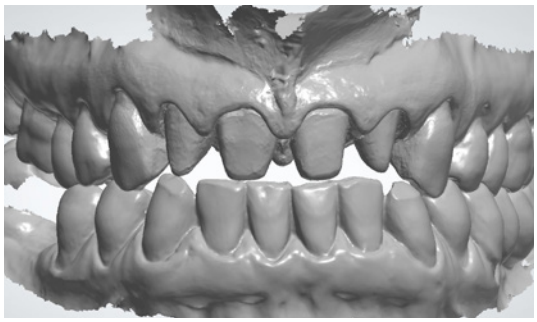


Fig. 3: Digital model of the prepared teeth imported into the CAD software.

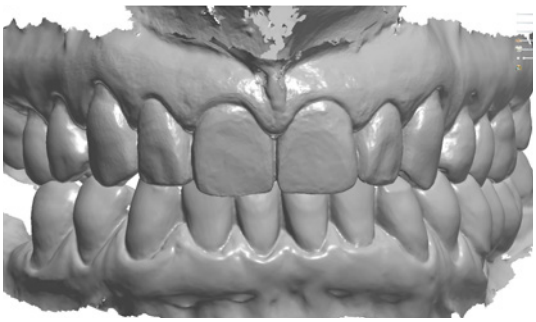


Fig. 4: Digital model of the teeth with temporary imported into the CAD software.

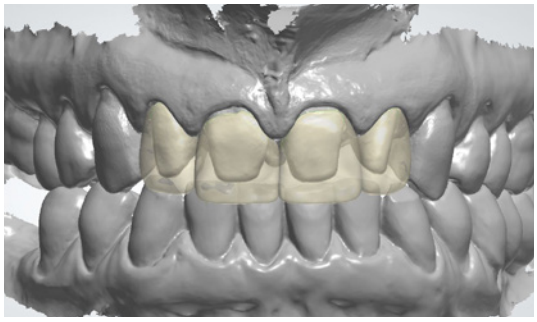


Fig. 5: Designing of four zirconia crowns: Transparent view.

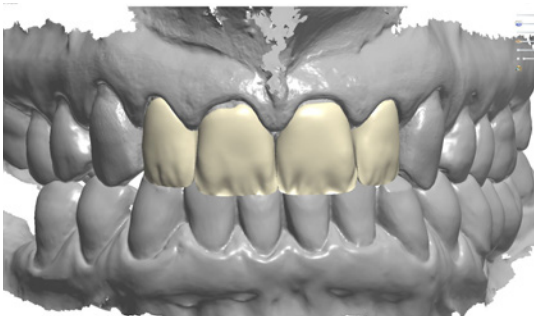


Fig. 6: Designing of four vestibular enamel cutback zirconia crowns.

Dentin structure with internal anatomy

In the present case, "KATANA™ Zirconia" STML, in the shade A2, was selected based on the desired appearance of the final restorations, the colour of the abutment teeth and the space available. The selected design was a minimal vestibular cutback, while the palatal zirconia was left untouched. To replicate the natural aesthetics, we opted for vestibular micro-layering with single luster porcelain and specific internal design of the mamelons.

In order to achieve the best possible aesthetics, it is fundamental to incorporate the internal anatomy into the pre-sintered vestibular surface, and to precisely follow the recommended sintering protocol. Only a flawless sintering procedure will lead to the ideal translucency and correct shade appearance. Following sintering, the surface should be treated with a sandblasting unit (aluminium oxide, particle size 50 µm, pressure 1 to 2 bar).

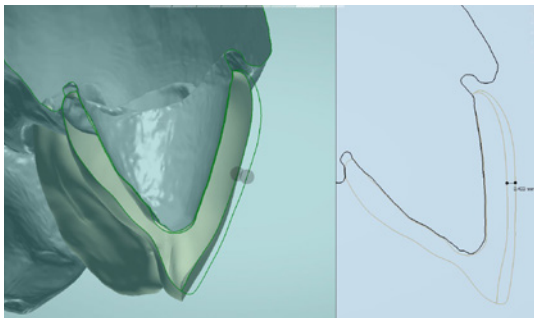


Fig. 7: Cross-sectional view for a check of the correct thickness.

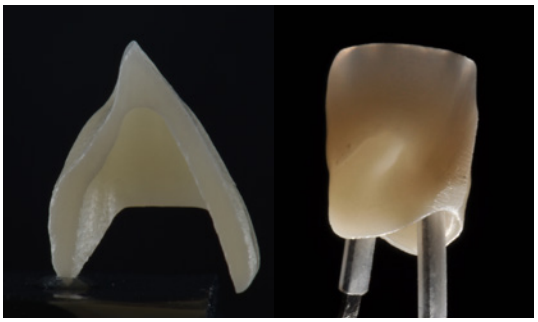


Fig. 8: Crown made of "KATANA™ Zirconia" STML after sintering.

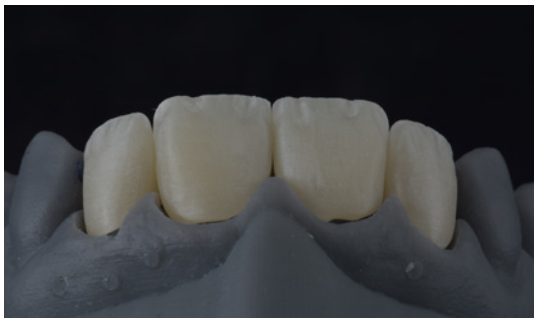


Fig. 9: Checking the fit of the crowns on the printed working model.

Fig. 10: ILS technique: colour map.

Fig. 11: Application of "CERABIEN™ ZR" Internal Stains.

INTERNAL STAIN ADVANTAGES

- Powder becomes gel and is always ready for use
- The real colours are revealed already before baking
- Optical effects are achieved simply and rapidly
- Excellent adhesion to zirconia is ensured

To improve the mimicry effect, we use the internal light stain technique on the zirconia surface. Incisal Blue one is applied around the mamelons, Mamelon Orange 2 directly on the mamelons for a natural effect. For a calibrated chromaticity, A+ may be added in the cervical area.

Fig. 12: Appearance of the internal stains on the surface after firing.

Fig. 13: Light dynamics after firing.

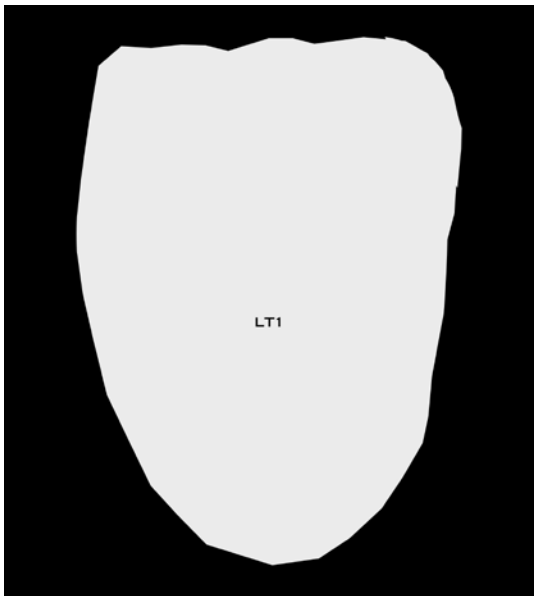


Fig. 14: Luster layer: Colour map.

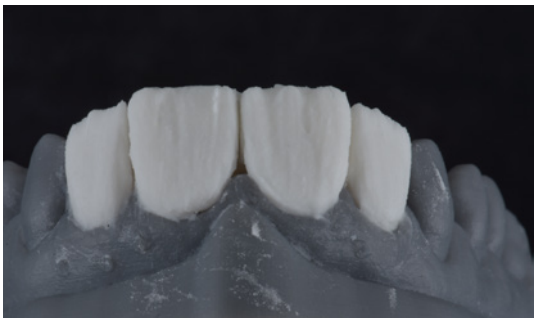


Fig. 15: "CERABIEN™ ZR" Luster Porcelain LT1 applied in a micro layer.

Fig. 16: Layering with LT1.

The vestibular body and incisal morphology are completed by adding a single ceramic micro layer of CZR Luster Porcelain LT1.

Before finalizing the restorations, the zirconia surface and texture were optimized with a stone and rubber polishers.

Fig. 17: Appearance of the minimal ceramic layer after a single firing procedure.

Fig. 18: Light dynamics after firing.

Polishing of the palatal surface was accomplished with Pearl Surface Z diamond paste before a final self-glaze step in the furnace.

Fig. 19: Final crowns after mechanical polishing.

Fig. 20: Check on the elements will be carried out on the printed digital model.

Fig. 21: Final situation after cementation.

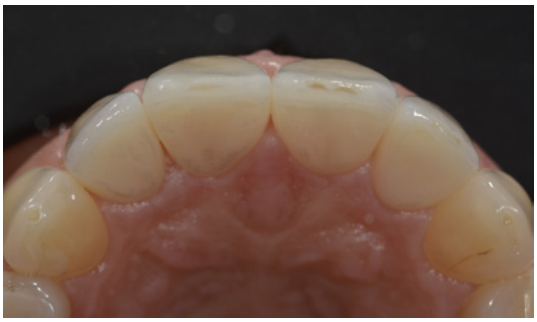


Fig. 22: Palatal view of the final situation.

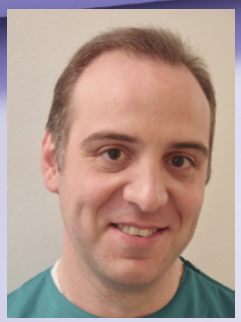
Conclusion

Considering aesthetic requirements and case difficulty, today it is possible to adopt different 4.4.1. approaches. In combination with the present generation of multi-layered zirconia, they allow the modern technician to make the best use of digital means to solve complex cases in an easy, effective, and successful manner.

The 4.4.1. system is recommended because it is a selection of materials used in a number of combinations, which help us achieve aesthetically sophisticated outcomes in a feasible, flexible and repeatable way.

FOR BONDING PROCEDURES OF METAL-FREE FIXED DENTAL PROSTHESES

KATANA™ Cleaner



DR STEFANO DANIELE

Dr Stefano Daniele received his dentistry degree from the University of Milan in Italy in 2001. He is in private practice in Milan and is an academic tutor in restorative dentistry in the Department of Biomedical, Surgical and Dental Sciences at the Faculty of Medicine of the University of Milan and is located at the San Paolo hospital in Milan. He was a visiting professor at the Università degli Studi del Piemonte Orientale "Amedeo Avogadro" in Novara in Italy, teaching restorative dentistry and dental materials until 2013.

During bonding procedures for metal-free fixed dental prostheses (FDPs), try-in with specific cement shade matching glycerine paste is necessary for choosing the correct shade of resin-based cement. During try-in, however, saliva and blood could contaminate the bonding surfaces of the ceramic and dental hard tissue. It is essential for the ceramic surface and dental hard-tissue surface to be perfectly clean of bacterial biofilm and other contaminants before adhesive application. Both the procedures ensure efficient bonding and long-term reliability of the adhesive fixed prosthetic intervention.

Cleaning the ceramic bonding surface after try-in

Try-in of metal-free fixed dental prostheses (FDPs) is a key procedure for evaluating the fit of the finishing line of the dental preparation and, for very thin veneers, for matching the resin-based cement to be used to bond the ceramic restorations to the dental hard tissue. Aesthetic features—value in particular—of thin veneers depend on different factors, and one of the most important is the choice of shade of the resin-based cement used under the thin ceramic. To make this procedure easier and repeatable, many manufacturers provide glycerine pastes

It is essential for the ceramic surface and dental hard-tissue surface to be perfectly clean.

A perfectly clean ceramic bonding surface is important for obtaining an effective micromechanical interlocking between glass-ceramic and cement.

that have the same colours as those of the corresponding resin-based cements. This pre-bonding procedure of try-in of metal-free FDPs enables the selection of the most appropriate resin-based cement. Glycerine pastes are generally hydrophilic and can be rinsed from the ceramic bonding surface after try-in with an air–water spray, but some contaminants, such as saliva, blood and crevicular fluid, may remain on the surface, and this may affect the efficacy of the bond to the dental hard tissue. Sandblasting contaminated surfaces of metal-free FDPs may be the best choice for removing contaminants from bonding surfaces, but it is important to consider that not all dentists have sandblasting devices in their offices. To this end, Kuraray Noritake Dental launched KATANA™ Cleaner, a specific detergent for decontaminating the bonding surfaces of ceramics that is able to provide complete removal of contaminants from the bonding surfaces of metal-free FDPs after the try-in procedure. A perfectly clean ceramic bonding surface is important for obtaining an effective micromechanical interlocking between glass-ceramic and cement, as well as for allowing the chemical bond reaction between a 10-MDP-based primer and the zirconia bonding surface.

Cleaning the dental hard-tissue bonding surface when sandblasting is not recommended

The dental hard-tissue bonding surface must be clean before bonding metal-free FDPs, and this procedures can be done by sandblasting with a 'soft' powder such as erythritol. The focus of this procedure would not be to create an additive retention rate for the ceramic surface, but instead to remove the bacterial biofilm from the dental hard-tissue surface before bonding. Actually, metal-free FDPs are designed to have supra gingival finishing lines. Supra gingival preparation is also important for permitting perfect isolation with a rubber dam. In clinical practice, often the finishing line may be (partly) sub gingival for specific reasons, for example in veneer preparation designed to close diastemas and cervical black triangles between anterior teeth. In those clinical cases, dental dam application may be difficult, and sandblasting dental hard tissue may pose too high a risk of periodontal tissue bleeding. Tissue bleeding near the cervical margin of the preparation before adhesive bonding procedures for metal-free FDPs may affect the seal between the restorative and preparation. These clinical situations indicate the use of cleaning agents rather than sandblasting to clean surfaces before bonding.

Limitations of conventional agents used to clean bonding surfaces

Most conventional cleaning agents are not effective cleaners of ceramic, including zirconia, surfaces of metal-free FDPs and dental hard-tissue surfaces when sandblasting is contra-indicated as described. The following is a short list of the limitations and adverse effects of the main detergents used in clinical practice before bonding procedures:

- **Ethanol:** It is not a very effective contaminant remover and is not able to remove saliva and blood proteins fully. Often ethanol fixates proteins rather than removing them.
- **Sodium hypochlorite:** It has good efficacy as a cleaner, including removal of saliva and blood proteins, but may have an adverse impact on bonding procedures owing to its oxidisation properties (free radicals released from a sodium hypochlorite reaction could result in interference with autopolymerisation and light polymerisation of resin monomers).[1]
- **Hydrogen peroxide:** It does not have any contaminant-removing properties and, to a greater extent than sodium hypochlorite, could result in interference with free-radical polymerisation of resin-based materials used for adhesive procedures.
- **Chlorhexidine:** It does not have any adverse effect but also no capability of removing contaminants.

KATANA™ Cleaner and its specific features

KATANA™ Cleaner is a specific detergent solution for cleaning the surfaces of all kinds of prostheses, either metal based or metal free and for the adherent surfaces of dental hard tissue. KATANA™ Cleaner is for both extra-oral and intra-oral use. The chemical composition of KATANA™ Cleaner includes 10-MDP and a 10-MDP triethanolamine (TEA)-salt in an aqueous solution. 10-MDP-TEA is an emulsifier and surfactant compound able to solubilise

many substances not soluble in water and to increase the wetting capacity of those. These chemical features of 10-MDP-TEA allow easier removal of contaminants from surfaces using water spray in order to obtain a clean surface. KATANA™ Cleaner is mainly targeting proteins; saliva, blood and the like. The 10-MDP-TEA-salt is amphiphilic. The non polair part enters the contamination forming micelles. the micelles are easy to rinse of with an air-water spray.

KATANA™ Cleaner is a powerful concentrated cleaner. It has a mild pH of 4,5 thus no adverse etching of the dental hard tissue. The presence of 10-MDP in the solution makes it compatible with all dental bonding agents. KATANA™ Cleaner is a purple-coloured solution, and this feature permits easy and accurate application on all surfaces to be cleaned. An easy flow chart follows that explains the use of KATANA™ Cleaner after try-in with glycerine paste before adhesive cementation of (metal-free) FDPs.

REMOVE THE MAJORITY OF THE GLYCERINE PASTE FROM THE BONDING SURFACES OF THE METAL-FREE FDPS BY RINSING WITH WATER

APPLY KATANA™ CLEANER ON TO THE BONDING SURFACES OF THE FDPS AND DENTAL HARD TISSUE AND RUB IT IN FOR 10 SECONDS

RINSE KATANA™ CLEANER FROM THE SURFACES AND DRY WITH AN AIR SPRAY.

THE BONDING SURFACES OF THE FDPS AND DENTAL HARD TISSUE ARE READY FOR FURTHER ADHESIVE PROCEDURES.

Fig. 1: Using KATANA™ Cleaner on the bonding surfaces of metal-free fixed dental prostheses and dental hard tissue after try-in and before bonding.

Fig. 2: Ceramic partial fixed dental prostheses (veneers) before the try-in.

Fig. 3: Glycerine paste used for the try-in.

Fig. 4: Veneer try-in.

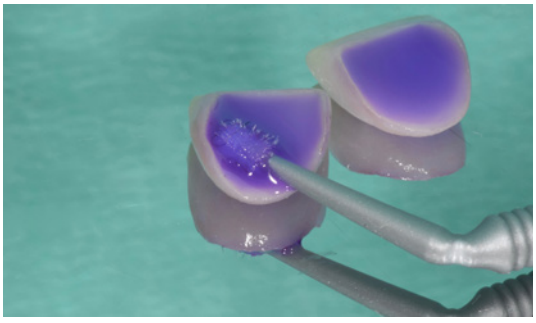


Fig. 5: Use of KATANA™ Cleaner to remove remains of try-in gel and contaminants, such as saliva, from the bonding surfaces of the fixed dental prostheses.

CLINICAL CASE 1: Cleaning of "KATANA™ Zirconia" UTML FDPs after try-in using KATANA™ Cleaner

Fig. 6: "KATANA™ Zirconia" UTML fixed dental prostheses.

Fig. 7: Cleaning the fixed dental prostheses with KATANA™ Cleaner after the try-in.

Fig. 8: Tooth preparation cleaned with KATANA™ Cleaner before adhesive application and resin cementation.

Fig. 9: Fixed dental prostheses *in situ* at the recall appointment.

CLINICAL CASE 2: Tooth surface cleaning using KATANA™ Cleaner

Fig. 10: Ceramic partial fixed dental prostheses (veneers) before try-in and bonding procedures.

Fig. 11: Cleaning of the dental hard-tissue bonding surfaces in a clinical situation where sandblasting was not recommended owing to the high risk of periodontal soft-tissue bleeding.

Fig. 12: Bonded partial fixed dental prostheses at the recall appointment.

Fig. 13: Perioral aspect of the veneers during smiling.

Acknowledgements:

Special thanks go to master dental technician Daniele Rondoni for the fabrication of the metal-free FDPs.

Reference

1. Lai SC, Mak YF, Cheung GS, Osorio R, Toledano M, Carvalho RM, Tay FR, Pashley DH. Reversal of compromised bonding to oxidized etched dentin. J Dent Res. 2001 Oct;80(10):1919–24. doi: 10.1177/00220345010800101101.

kuraray

Noritake

DO YOU SEE ANY CONTAMINATION?

Of course not!

KATANA™ CLEANER IS THE FIRST INTRA- AND EXTRA-ORAL UNIVERSAL CLEANER

During trial fitting your restoration might become contaminated with proteins reducing the bond strength. KATANA™ Cleaner removes contamination to optimise your adhesive procedures.
Rub, rinse and dry - that's all you need to do.

CLEANERS COMPARISON	KATANA™ CLEANER	OTHER BRANDS*
Extra-oral use	✓	✓
Intra-oral use on Tooth Structure	✓	✗
Intra-oral use on Implant Abutments	✓	✗
Application Time	10 sec.	20+ sec.
Handling	No shaking Single handed	Shake before use

BORN IN JAPAN

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*Ivoclean (Ivoclar Vivadent) and ZirClean (Bisco)