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CONTENTS

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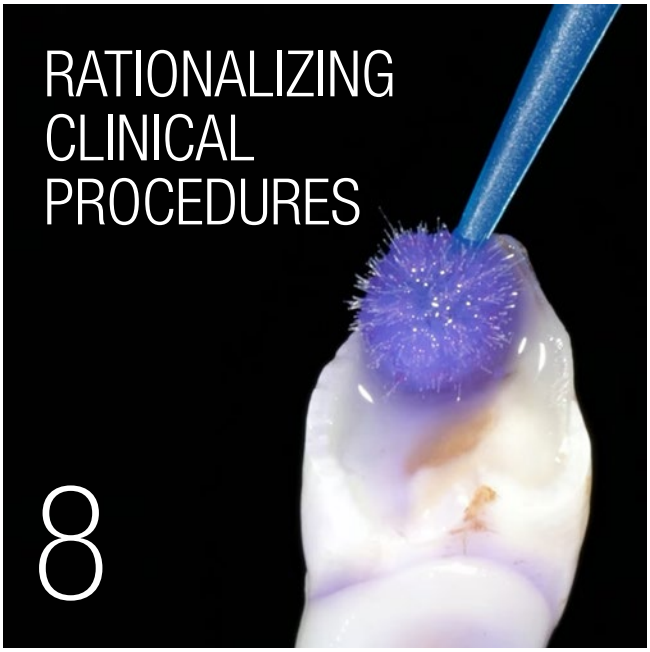
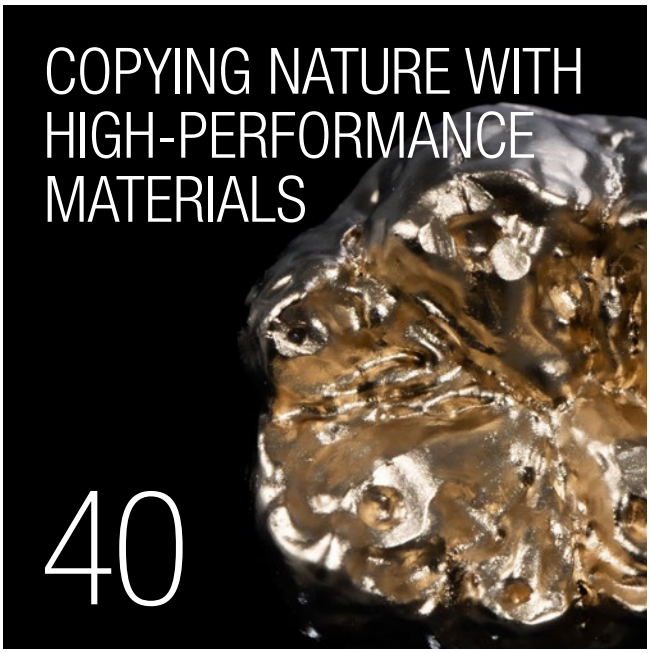
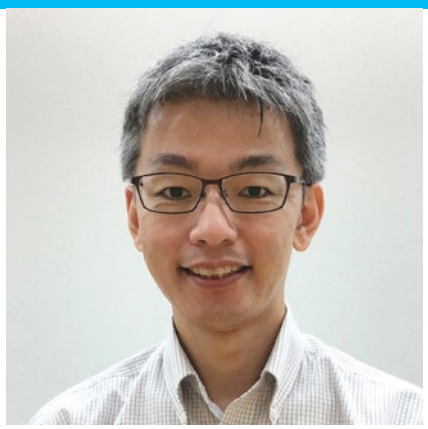




SOLUTIONS FOR INDIVIDUALIZED, PATIENT-CENTERED DENTISTRY



YUSUKE FUJIMURA
Head of Marketing & Technical Management Europe

Dear reader,

Nowadays, most patients requiring or desiring dental treatment know exactly what they want. They have already retrieved information from the internet, have developed aesthetic expectations and are looking for a dental professional who is willing and able to listen to them. Those who listen closely – no matter whether dental practitioner or dental technician – are in need of easy-to-use, high-performance materials that support them in delivering highest-quality outcomes targeted to the individual expectations of each patient.

At Kuraray Noritake Dental Inc., we are committed to delivering exactly the materials needed for this task. Based on continuous innovation and a never-tiring striving for excellence, we develop and market adhesives, resin cements, direct restoratives, CAD/CAM blocks and discs for indirect restorations, finishing solutions and much more. All are developed with their users' current needs in mind, hence allowing for efficient, streamlined workflows that lead to aesthetic and durable outcomes.

However, there is more to delivering state-of-the-art dental treatment than just using high-quality dental materials. To exploit their full potential and maximize the positive effects associated with their use, the implementation of modern treatment approaches and techniques is highly recommended. Many of them have been developed by skilled colleagues in their own dental offices or laboratories. As we believe that sharing ideas and knowledge can be valuable for any like-minded individual, we have asked them to submit their ideas for the creation of this 11th issue of the BOND Magazine.

Authored by or created in close collaboration with those skilled and experienced professionals, these contributions reveal how to use specific products and techniques, offer completely new technique options and share their personal philosophies. For example, Prof. Dr. Lorenzo Breschi describes selective adhesive luting as a novel approach for luting when restoring short abutment teeth or those with deep preparation margins. Guidance on how to use universal direct restorative solutions is provided by José Ignacio Zorzin. Laboratory workflows and philosophies, on the other hand, take center stage in the interviews with Alexander Aronin and Andreas Chatzimpatzakis.

Enjoy reading!

With my best regards,

Yusuke Fujimura,
Head of Marketing &
Technical Management Europe

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Michał Jaczewski during his presentation at the Kuraray Noritake Dental booth in Cologne.

FLOWABLE INJECTION TECHNIQUE:

SIMPLE, PREDICTABLE AND REPEATABLE

INTERVIEW WITH MICHAŁ JACZEWSKI

The flowable injection technique is becoming a popular technique used to aesthetically restore multiple teeth with flowable composite. A renowned instructor who teaches dental practitioners the skills needed to use the technique successfully is Michał Jaczewski. He graduated from Wroclaw Medical University (Poland) in 2006 and has run his own private practice in the city of Legnica since 2011. He is the founder of the Biofunctional School of Occlusion, which conducts trainings in the field of comprehensive dental treatments, and is passionate about aesthetic digital dentistry. At the International Dental Show 2023 in Cologne, he showed us when, why and how he uses flowable injection in his dental office.

Could you please describe the technique in a few words?

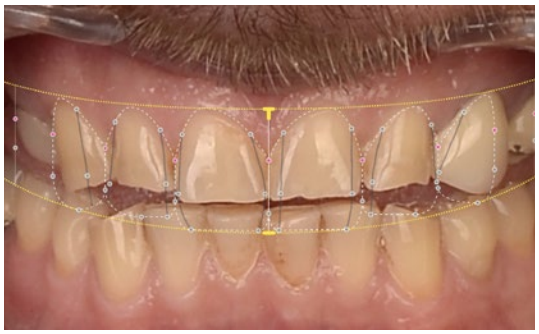
The flowable injection technique is a simple, predictable, repeatable way to restore teeth using flowable composite. It is based on a wax-up, over which a silicone index is produced. This index then serves as the key for the injection of the flowable composite, which is light-cured through the transparent silicone. The most important benefit is that this technique works without or in some cases with a very minimal tooth preparation. It is a minimally invasive technique that can be used both by beginners and by experienced dentists. Using a composite with a well-balanced opacity in a thickness of 0.3 mm and a special polishing protocol, it is possible to achieve excellent morphological and optical outcomes.

When did you start using the flowable injection technique and what are its major indications?

I started using the technique in 2018. It was originally invented to restore anterior teeth, but nowadays, it is successfully used in the posterior region as well. To my mind, it is particularly useful whenever the shape of multiple teeth needs to be corrected to improve a patient's smile, no matter whether young or old. This may be the case after orthodontic treatment. The teeth are simply aligned and then restored to the perfect shape using this non-invasive technique. I also use flowable injection for a smile makeover, to restore worn teeth and to change the vertical dimension of occlusion in the context of full-mouth reconstructions. In the latter case, the restoration may be temporary and used for a mid- to long-term "test drive". However, it can also serve as the final restoration.

How do you start when planning to restore a patient's teeth with the flowable injection technique?

The most important phase heavily influencing the success of this technique is the planning phase. It consists of documentation, impression taking and the creation of a wax-up and mock-up as well as the production of the silicone index. You can of course work in the traditional way with a silicone impression and conventional wax-up, but the use of digital technologies in this phase will improve your workflow significantly. I usually start with photo and video documentation and a digital impression. Records of the centric relation and occlusion are needed as well. Then, a virtual wax-up is created using digital smile design software. In this step, it is important to take into account the facial characteristics of the patient, a task that is best accomplished using the facial flow concept. Based on the resulting design, a virtual treatment outcome can be displayed and discussed with the patient. Once approved, the model with wax-up is printed in different versions: the full wax-up model and an "interlip model"

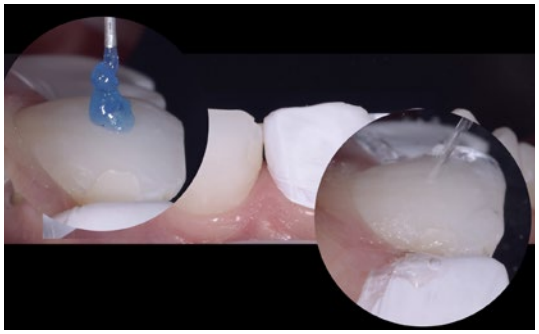


Digital Smile Design: Patient with severe tooth wear.

Virtual wax-up displayed in the patient's mouth.

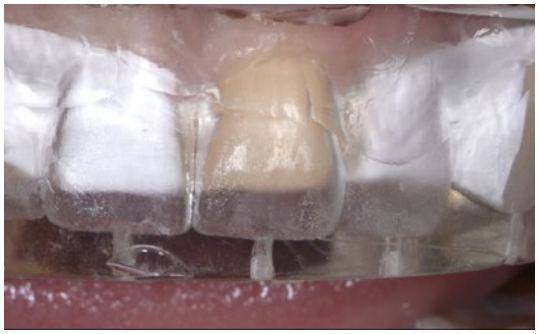
Models printed on the basis of the virtual mock-up.

Silicone index produced on the alternating (interlip) model.



Etching of the enamel with phosphoric acid etchant.

Application of CLEARFIL™ Universal Bond Quick.



Complete silicone index in place.

Situation immediately after the injection of CLEARFIL MAJESTY™ ES Flow (Low), light curing and removal of the silicone index.

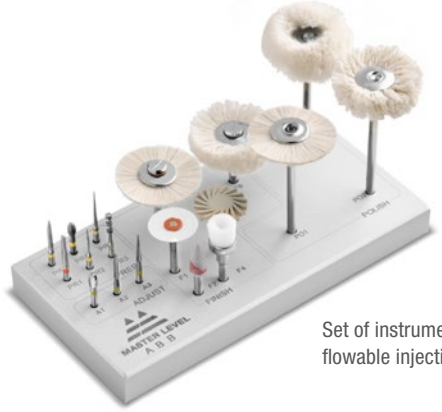
with an alternating design – one tooth with wax-up followed by one tooth without. These models are used to produce the required indexes made of transparent silicone.

When and why do you produce more than one silicone index?

It is particularly useful to work with the complete and the alternating (partial) silicone index when planning to restore all teeth in the maxilla. Starting with the alternating index gives me additional stability and lays the foundation for a precise outcome especially with regard to the planned occlusal height. In the lower jaw, where the handling of the index and the composite is more difficult due to the presence of saliva and moving soft tissues, I always recommend to divide the working field into three sections – one anterior and two posterior regions – and work on them separately.

How do you prepare the teeth and inject the flowable composite?

In most cases, all we need is a roughening of the enamel surfaces for the bonding procedure, which is usually possible by air abrasion with aluminum oxide (50 µm at low pressure). Then, the enamel is etched with phosphoric acid etchant and a universal bonding agent is applied. The silicone index is equipped with an injection hole on the incisal edge. This is easily accomplished with the cannula of the flowable composite syringe pressed through the material from the inside to the outside. In the posterior region, it may be useful to utilize a harder material and integrate two holes for each tooth on separate cusps – one for the injection and one for the outward flow. On a hard index, a diamond bur is needed for this procedure. I place the index, inject the flowable composite from the bottom to the top, light-cure the material shortly and remove the index. Final polymerization is carried out after index removal and the application of a layer of glycerin gel. Once the excess material is removed and the proximal part of the restoration is finished perfectly, the procedure is repeated for the other teeth before the restorations are polished.



Set of instruments for the flowable injection technique.

Proximal adjustments with rotating instruments.

Do you have any favourite products for the technique?
For the silicone index, I use EXACLEAR (GC), as it is the most transparent silicone available on the market. My favourite composite for the flowable injection technique is CLEARFIL MAJESTY™ ES Flow of low viscosity (Kuraray Noritake Dental Inc.). In my dental office and during my courses, I had the chance to test a lot of different products. In this context, I found that the material from Kuraray Noritake Dental offers a few advantages. It is a modern type of nano composite with a wide range of indications and a large shade offering. With its three viscosities, it can be used in many different clinical situations. I started using it five years ago and for the flowable injection technique, the Low variant is my first choice, as it is the most universal one suitable for anterior and posterior teeth. The most decisive advantages that influenced my decision to use it are its natural aesthetics and superior polishability. You can achieve a spectacular effect without any special skills. As a bonding agent, I prefer to use CLEARFIL™ Universal Bond Quick, which makes my workflow even easier, faster and more predictable. For polishing, I have developed my own protocol.

How do you finish and polish your restorations?
I start in the proximal area with polishing strips and sometimes a proximal saw. For shape adjustments, three different diamond and carbide burs have proven their worth. Subsequently, I proceed with fine or extra fine Sof-Lex™ Finishing and Polishing Discs (3M) used for contouring and finishing and rubber polishers TWIST DIA™ for Composite (Kuraray Noritake Dental Inc.), which already create a nice, natural surface gloss with low effort. Then, a wheel brush made of goat hair is used with diamond polishing paste (Diamond excel, FGM) and finally, I use a cotton wheel along with an aluminum oxide polishing paste (Pasta Grigia II, anaxDENT). In this way, it is possible to create a mirror finish.

What are the biggest benefits of the flowable injection technique?
For patients and dental practitioners, the biggest advantages are savings in time and money. Many patients cannot afford ceramic veneers, and they are extremely happy to be offered a high-quality alternative that can be delivered in a single appointment. The procedure is prepless and the restorations can easily be repaired or the colour changed if they wish, so that there is virtually no risk involved in the treatment. Dental practitioners are usually able to start treating patients after they have attended a single course. While practicing makes them perfect, the first results are often already quite impressive, so that there is no huge investment involved for beginners – neither in time nor in new materials. Of course, you can invest lots of time in the finishing and polishing procedure, but I am sure you will find the right balance between effort and outcome.

Do you have any recommendation of how to start using the technique?
First of all, I would like to encourage everyone to leave their comfort zone and try something new on a regular basis. For me, starting to work with the flowable injection technique was a real gamechanger, and I would never want to work without it again. Before starting to use the technique, I would definitely attend a course that teaches you all the theoretical knowledge needed for a successful first case, and maybe even a practical workshop. I offer both kinds of courses on a regular basis, and my lecture and hands-on demonstration just given here at the IDS 2023 gives you a foretaste of what you may expect.

UNIVERSAL ADHESIVES: RATIONALIZING CLINICAL PROCEDURES

CASE REPORT WITH DR. JOSE IGNACIO ZORZIN

Rationalizing clinical workflows: This is the main reason for the use of universal products in adhesive dentistry. They are suitable for a wide range of indications and different application techniques, fulfil their tasks with fewer components than conventional systems and often involve fewer steps in the clinical procedure. Universal adhesives are a prominent example.

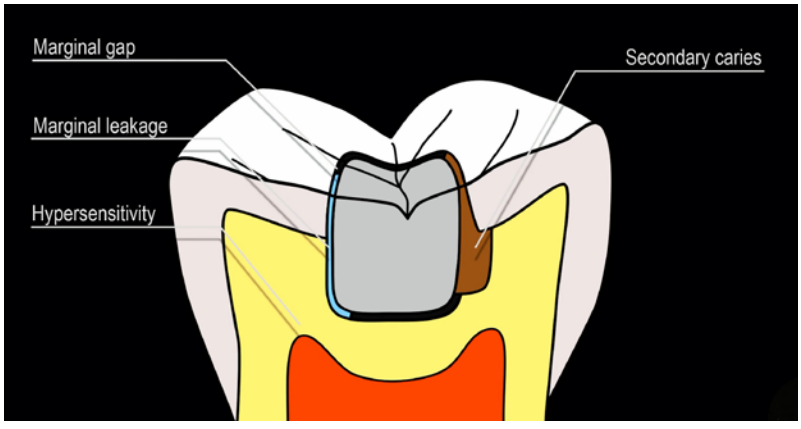


Fig. 1: Volumetric shrinkage of resin composite restoratives and its clinical consequences.

How do universal adhesives contribute to a streamlining of workflows?

When restoring teeth with resin composite, the restorative material will undergo volumetric shrinkage upon curing. By bonding the restorative to the tooth structure with an adhesive, the negative consequences of this shrinkage – marginal gap formation, marginal leakage and staining, hypersensitivity issues and the development of secondary caries – are prevented.

The first bonding systems available on the dental market were etch-and-rinse adhesives, which typically consisted of three components: an acid etchant, a primer and a separate adhesive. Later generations combined the primer and the adhesive in one bottle, or were two or one-bottle self-etch adhesives. Universal adhesives (also referred to as multi-mode adhesives) may be used with or without a separate phosphoric acid etchant.

Which technique to choose depends on the indication and the clinical situation. In most cases, the best outcomes are obtained after selective etching of the enamel[1]. Bonding to enamel is generally found more effective when the enamel is etched with phosphoric acid, while the application of phosphoric acid on large areas of dentin involves the risk of etching deeper than the adhesive is able to hybridize. When the cavity is small, however, selective application of the phosphoric acid etchant to the enamel surface may not be possible, so that a total-etch approach is most appropriate. Finally, in the context of repair, the self-etch approach may be the first choice, as phosphoric acid might impair the bond strength of certain restorative materials by blocking the binding sites. By using a universal adhesive, all these cases may be treated appropriately, as the best suitable etching technique can be selected in every situation.

Apart from the differences related to the use or non-use of phosphoric acid etchant on the enamel or enamel-and-dentin bonding surface, the clinical procedure is always similar with the same universal adhesive. The following clinical case is used to illustrate how to proceed with CLEARFIL™ Universal Bond Quick (Kuraray Noritake Dental Inc.) in the selective enamel etch mode, and it includes some details about the underlying mechanism of adhesion.

How to proceed with selective enamel etching? A clinical example.

This patient presented with a fractured maxillary lateral incisor, luckily bringing the fragment with him. Hence, it was decided to adhesively lute the fragment to the tooth with an aesthetic flowable resin composite.

Fig. 2: Patient with a fractured maxillary lateral incisor.

Fig. 3: Close-up of the fractured tooth.

Fig. 4: Working field isolated with rubber dam.

Fig. 5: Cleaning of the tooth structure with KATANA™ Cleaner.

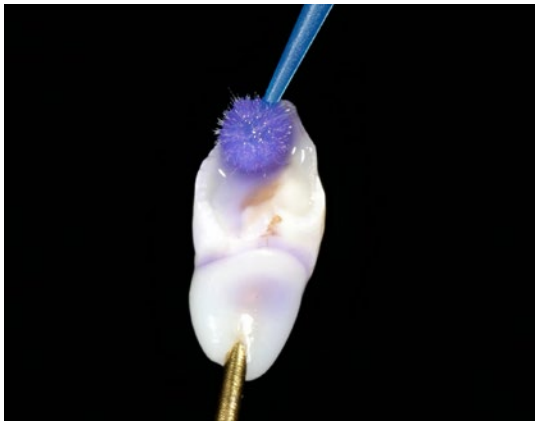


Fig. 6: Cleaning of the fragment with KATANA™ Cleaner.

As proper isolation of the working field makes the dental practitioner's life easier, a rubber dam was placed using the split-dam technique. It works well in the anterior region of the maxilla, as the risk of contamination with saliva from the palate is minimal. Once the rubber dam was placed, the bonding surfaces needed to be slightly roughened to refresh the dentin. As the surfaces were also slightly contaminated with blood and it is important to have a completely clean surface for bonding, KATANA™ Cleaner was subsequently applied to the tooth structure, rubbed into the surfaces for ten seconds and then rinsed off.
The cleaning agent contains MDP salt with surface-active characteristics that remove all the organic substances from the substrate. The fragment was fixed on a ball-shaped plugger with (polymerised) composite and also cleaned with KATANA™ Cleaner.

What followed was selective etching of the enamel on the tooth and the fragment for 15 seconds. Whenever selective enamel etching is the aim, it is essential to select an etchant with a stable (non-runny) consistency – a property that is offered by K-ETCHANT Syringe (Kuraray Noritake Dental Inc.). Both surfaces were thoroughly rinsed and lightly dried before applying CLEARFIL™ Universal Bond Quick with a rubbing motion. This adhesive is really quick: Study results show that the bond established immediately after application is as strong and durable as after extensive rubbing into the tooth structure for 20 seconds.[2,3]
The adhesive layer was carefully air-dried to a very thin layer and finally polymerized – on the tooth and on the fragment.

Fig. 7: Selective etching of the enamel of the tooth …

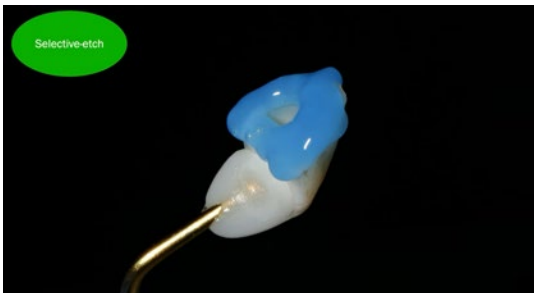


Fig. 8: … and the fragment with phosphoric acid etchant.

Fig. 9: Application …

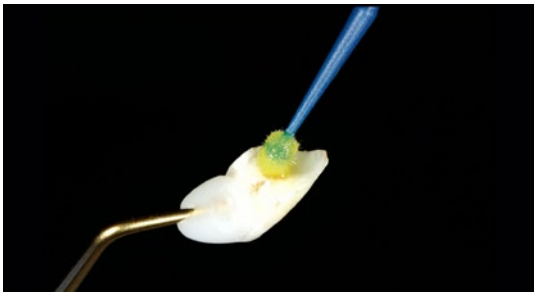


Fig. 10: … of the universal bonding agent.

Fig. 11: Polymerization of the ultra-thin adhesive layer on the tooth …

Fig. 12: … and the fragment.

What happens to dentin in the selective enamel etch (or self-etch) mode?

After surface preparation or roughening, there is a smear layer on the dentin surface that occludes the dentinal tubules, forms smear plugs that protect the pulp and prevents liquor from affecting the bond. When self-etching the dentin with a universal adhesive, this smear layer is infiltrated and partially dissolved by the mild self-etch formulation (pH > 2) of the universal adhesive. At the same time, the adhesive infiltrates and demineralizes the peritubular dentin. The acid attacks the hydroxyapatite at the collagen fibrils, dissolves calcium and phosphate and hence enlarges the surface. Then, the 10-MDP contained in the formulation reacts with the positively loaded calcium (and phosphate) ions. This ionic interaction is responsible for linking the dentin with the methacrylate and thus for the formation of the hybrid layer[4,5].

In the total-etch mode, the phosphoric acid is responsible for dissolving the smear layer and demineralising the hydroxyapatite. This leads to a collapsing of the collagen fibrils, which need to be rehydrated by the universal adhesive that is applied in the next step. Whenever the acid penetrates deeper into the structures than the adhesive, the collagen fibrils will remain collapsed. This will most likely result in clinical issues including post-operative sensitivity[6].

When applying the adhesive system, a dental practitioner rarely thinks about what is happening at the interface[7]. However, every user of a universal adhesive should be aware of the fact that a lot is happening there. This is why it is so important to use a high-performance material with well-balanced properties and strictly adhere to the recommended protocols.

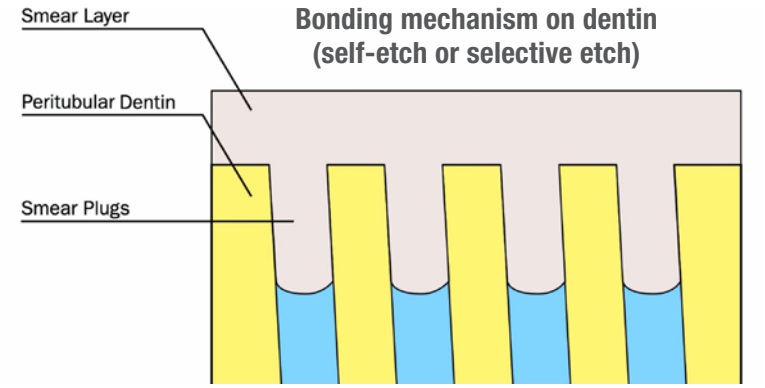


Fig. 13: Schematic representation of dentin after tooth preparation: The smear layer on top with its smear plugs occluding the dentinal tubules protects the pulp and prevents liquor from being released into the cavity.

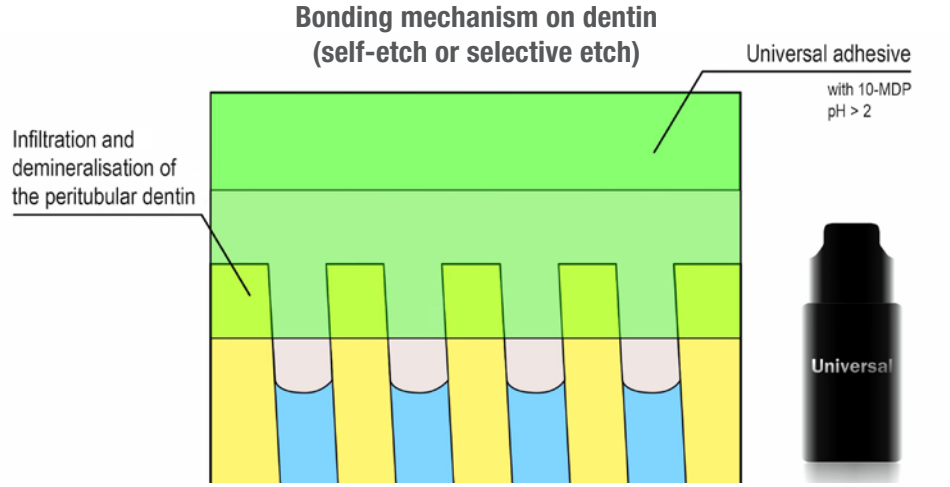


Figure 14: Schematic representation of dentin after the application of a universal adhesive containing 10-MDP: The mild self-etch formulation partially dissolves and infiltrates the smear layer, while at the same time demineralizing and infiltrating the peritubular dentin[5].

Fig. 15: Reconnecting the fragment with the tooth structure.

Fig. 16: Treatment outcome.

In the present case, the tooth and the fragment now needed to be reconnected. For this purpose, CLEARFIL MAJESTY™ ES Flow (A2 Low) was applied to the tooth structure. The fragment was then repositioned with a silicone index, held in the right position with a plier and light cured. To obtain a smooth margin and glossy surface, the restoration was merely polished. The patient presented after 1.5 years for a recall and the restoration was still in a perfect condition.

Why is it important to adhere to the product-specific protocols?

Universal adhesives contain lots of different technologies in a single bottle. While this fact indeed allows users to rationalize their clinical procedures, it also requires some special attention. As with every highly developed material, universal adhesives need to be used according to the protocols recommended by the manufacturer. In general, materials may only be expected to work well on absolutely clean surfaces, while contamination with blood and saliva is likely to decrease the bond strength significantly. Depending on the type of universal adhesive, active application is similarly important, as is proper air-drying and polymerization of the adhesive layer. In addition, care must be taken to use the material in its original state, which means that it needs to be applied directly from the bottle to avoid premature solvent evaporation or chemical reactions. When adhering to these rules, universal adhesives offer several benefits from streamlined procedures to simplified order management and increased sustainability, as fewer bottles are needed and likely to expire before use.

Dr. José Ignacio Zorzin graduated as dentist at the Friedrich-Alexander University of Erlangen-Nürnberg, Germany, in 2009. He obtained his Doctorate (Dr. med. dent.) in 2011 and 2019 his Habilitation and venia legendi in conservative dentistry, periodontology and pediatric dentistry ("Materials and Techniques in Modern Restorative Dentistry"). Since 2009, Dr. Zorzin has worked at the Dental Clinic 1 for Operative Dentistry and Periodontology, University Hospital Erlangen. He lectures at the Friedrich-Alexander University of Erlangen-Nürnberg in the field of operative dentistry where he leads clinical and pre-clinical courses. His main fields of research are self-adhesive resin luting composites, dentin adhesives, resin composites and ceramics, publishing in international peer-reviewed journals.

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SCAN ME

UNIVERSAL RESIN CEMENT:
DID YOU EVER THINK ABOUT A THIRD APPLICATION MODE?

ARTICLE BY PROF. LORENZO BRESCHI

Fewer bottles, more choices – this is possibly the shortest way to describe the category of universal resin cements. Being self-adhesive, these dual-cure resin-based cements allow for a single-component workflow without the need for separate tooth or restoration primers in many clinical situations. The bond strength obtained in this way is usually high enough to provide for a stable bond between the tooth and the restoration in a wide range of indications. However, it is slightly lower than that achieved with conventional resin cement systems consisting of several components (typically tooth primer, resin cement and restoration primer).

Apart from the self-adhesive application mode, universal resin cements may be combined with additional system components to increase the bond strength to tooth structure or the restorative material, respectively. This opens up new possibilities with regard to the product's use: depending on the required or desired bonding performance, the universal resin cement may be applied alone or in combination with a tooth primer, a restoration primer or both components. In addition, hybrid concepts become feasible, as explained in this article that focuses on PANAVIA™ SA Cement Universal (Kuraray Noritake Dental Inc.) as an example.

Self-adhesive luting: for many indications

PANAVIA™ SA Cement Universal is a dual-cure universal resin cement that is indicated for a wide range of applications when used in the self-adhesive mode. The bond established to restorative substrates (including silicate ceramics) is high without the use of a separate primer or silane[1-4]. This is due to two different adhesive monomers contained in the formulation – the Original MDP Monomer and the LCSi Monomer (a long carbon-chain silane coupling agent responsible for a strong chemical bond to silicate ceramics). Hence, it is possible to use the resin cement without any additional component applied on the side of the restoration – even in cases with a lack of retention and consequently high bond-strength requirements.

A strong bond to enamel and dentin is also obtained in the self-adhesive mode. In certain situations, however, it may be useful to further increase the bond strength to tooth structure with the aid of a tooth primer.

Adhesive luting: for challenging situations

The tooth primer recommended for PANAVIA™ SA Cement Universal is CLEARFIL™ Universal Bond Quick (Kuraray Noritake Dental Inc.). Its application is recommended whenever a user feels that the treatment would benefit from an extraordinarily strong and durable chemical bond, i.e. in particularly challenging situations with insufficient mechanical retention. The effectiveness of this measure

has been confirmed in an in-vitro study conducted in Japan, in which the 24-hour micro-tensile bond strength to dentin was increased significantly by the application of the universal adhesive[5]. When a separate adhesive is used, however, the importance of a completely dry working field increases. The reason is that the moisture tolerance of resin cements is usually higher than that of adhesives. Consequently, the application of a rubber dam is highly recommended.

Selective adhesive luting: for short abutments and subgingival margins

For situations in which proper isolation of the working field with a rubber dam is difficult, a third application option is available and proposed by a group of Italian researchers: Selective Adhesive Luting. In this case, CLEARFIL™ Universal Bond Quick is applied solely to those parts of the prepared tooth that allow for proper moisture control, while relying on the self-adhesive functionality of PANAVIA™ SA Cement Universal in areas where it is challenging to obtain the desired dry working field. Situations which are predestined for this technique are abutment teeth with a subgingival preparation margin and particularly short abutment teeth (that hinder the placement of a rubber dam).

The effectiveness of the selective adhesive luting technique has been verified in an in-vitro study that compared the three adhesive strategies – self-adhesive luting, full adhesive luting and selective adhesive luting – with the aid of shear bond strength testing[6]. The results of the tests show that users are able to enhance the bond strength of PANAVIA™ SA Cement Universal to dentin and enamel by applying the adhesive to a part of the tooth surface only. For the cementation system consisting of PANAVIA™ SA Cement Universal and CLEARFIL™ Universal Bond Quick, the full adhesive and the selective adhesive approach led to similar outcomes.

For situations in which proper isolation of the working field with a rubber dam is difficult, a third application option is available and proposed by a group of Italian researchers: Selective Adhesive Luting.

RECOMMENDED STEPS FOR SELECTIVE ADHESIVE LUTING

Fig. 1: Tooth preparation

Fig. 2: Selective etching of the enamel with phosphoric acid etchant

Fig. 3: Application of the universal adhesive + air-drying

Fig. 4. Crown placement after application of the resin cement into the crown

Fig. 5. Tack-curing

Fig. 6. Excess removal and final light curing

Fig. 7. Treatment outcome at a recall after one year

Benefits of selective adhesive luting

Apart from the desired (long-term) increase in bond strength achieved by applying a separate adhesive to a part of the or the whole prepared tooth surface, the technique offers additional benefits. Compared to multi-step cementation systems, the protocol is simplified as no separate restoration primer is needed. Light-curing of the adhesive is not required as long as the user stays within the recommended system. And in contrast to the full adhesive approach requiring rubber dam placement, the need for this step is eliminated in the selective adhesive approach. In this way, the chair-time is reduced and patient comfort increased.

Conclusion

Depending on the indication, clinical variables and individual preferences, users of universal resin cements like PANAVIA™ SA Cement Universal may select the technique that is likely to deliver the best clinical outcomes. It is this flexibility and the generally wide range of applications that makes the innovative product category truly universal. With fewer components to be used, universal materials facilitate the streamlining and standardization of clinical procedures, while with fewer bottles to be stored, they help staff gain control over order and storage management as well.

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He is Past-President of the Academy of Dental Materials (ADM), President-Elect of the European Federation of Conservative Dentistry (EFCD), President-Elect of the Dental Materials Group IADR, President-Elect of the Italian Academy of Conservative Dentistry (AIC), President-Elect of the International Academy of Adhesive Dentistry (IAAD).

THE ENDURING LEGACY OF MDP MONOMER

It is probably the best-known component of a dental product Kuraray Noritake Dental Inc. (Kuraray Noritake Dental) has ever developed: 10-Methacryloyloxydecyl Dihydrogen Phosphate, in short, the MDP monomer. Invented more than 40 years ago – the first product containing it was introduced in 1983 – MDP is still the leading functional monomer used to establish a long-term, durable and stable bond to hydroxyapatite in tooth structure and to metal oxides in restorative materials (oxide ceramics and metal alloys).

Nowadays, it is found in every dental adhesive and every component of a resin cement system with adhesive properties from Kuraray Noritake Dental.

In addition, MDP has become an integral part of most universal adhesives and many adhesive cementation systems of other manufacturers as well. However, not all MDP is alike …

MDP: Chemical structure and mechanism of adhesion

The MDP monomer consists of three essential parts: A polymerizable group, a hydrophobic group and a hydrophilic group. The co-polymerizable methacrylate group has a terminal double bond enabling polymerisation. The large hydrophobic alkylene group – also referred to as the spacer – has the task of maintaining a delicate balance between hydrophobic and hydrophilic properties of the monomer and offers great resistance to degradation. Finally, the hydrophilic phosphate group is responsible for acidic demineralisation, for chemical bonding with calcium in hydroxyapatite and for bonding with zirconia1 (as well as with metal).

Bonding performance

Lots of in-vitro studies have been carried out to investigate the bonding behaviour of 10-MDP in the context of direct and indirect restorative procedures. No matter whether

a cavity is to be filled with resin composite or an indirect restoration is to be placed, a strong and long-lasting bond to tooth structure needs to be established. The critical substrate in this context is dentin, while bonding to enamel is found to be less challenging. That is why it is so important that (self-etch) adhesives containing 10-MDP show an high bond strength to tooth structure, particularly to dentin[2]. In fact, 10-MDP also provides for a high bond stability over time by establishing an acid-base resistant zone on the adhesive interface[3]. This means that a great long-term performance may be expected. Fortunately, a great clinical long-term performance of products containing the MDP monomer has already been confirmed: a group from the University of Leuven (Belgium) has presented excellent results of a thirteen-year clinical trial involving the use of CLEARFIL™ SE BOND in 2015[4].

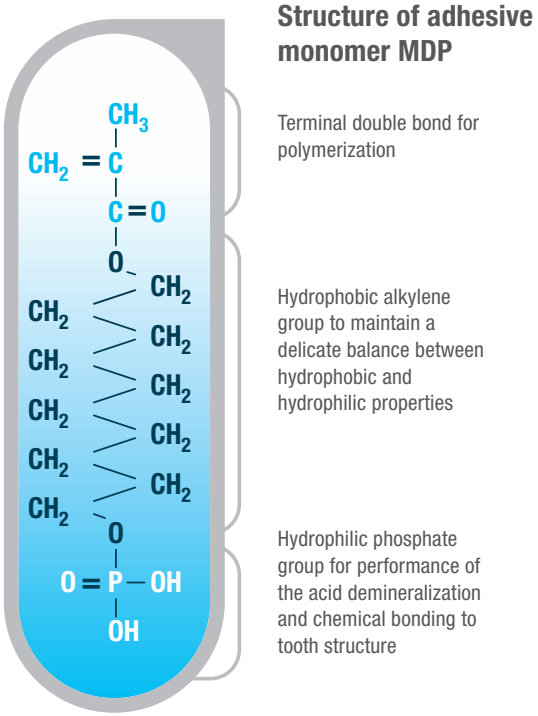
When bonding to indirect restorations made of zirconia, the surface area of the ceramic should be increased by sandblasting[5]. Pre-treated in the recommended way, the bond strength to zirconia tends to be particularly high when MDP-based resin cement systems are used[6]. It is thus widely recommended by experts in the field of adhesive dentistry to employ MDP-containing primers or resin cements for the placement of zirconia-based restorations, especially those with a non- or less retentive preparation. The fact that products containing 10-MDP work well in this context has been confirmed in different clinical studies with observation periods of up to 10 years[7,8]. The products used in these studies were PANAVIA™ 21, PANAVIA™ F2.0 and the latest version of the multi-component cementation system from Kuraray Noritake Dental, PANAVIA™ V5, which performed best.

Not all MDP is alike

Ever since the basic patent for MDP expired, other manufacturers of dental adhesives and adhesive resin cements have started integrating the functional monomers in their own products. However, it has been revealed that there are differences in the purity of the MDP monomers synthesized and used, and that these differences have an impact on the long-term bonding performance of the products containing the MDP[9]. According to in-vitro test results, the Original MDP Monomer synthesized by Kuraray Noritake Dental stands out due to an unmatched level of purity. This purity has a positive effect on the microstructure and thickness of the hybrid layer formed on dentin, the intensity of nano-layering and the bond strength measured immediately as well as after artificial aging[9].

Conclusion

The data summarized above reveals that after 40 years in clinical service, the Original MDP Monomer from Kuraray Noritake Dental is still a class of its own. It Has everything needed to establish a strong and long-lasting bond to tooth structure, resin composite and metal oxides, and is therefore a valuable component in virtually every adhesive system. In order to provide for a high bond quality, however, it may be best to use an MDP monomer with a confirmed high purity – the Original MDP Monomer.



Chemical structure of adhesive monomer 10-Methacryloyloxydecyl Dihydrogen Phosphate (MDP).

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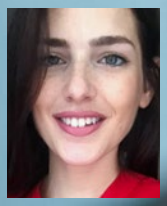
LARGE CAVITY RESTORATION WITH RESIN COMPOSITE:

WHICH MATERIALS TO CHOOSE?



VASILIKI TSERTSIDOU

What kind of resin composite is recommended for core build-up procedures? Despite availability of dual-cure core build-up resin composites available on the market, it's use is not mandatory. Light curing is advisable to be applied even for materials with dual-cure polymerization. Some conventional resin composites demonstrate even more favourable properties for a core build-up compared to specific core build-up resin composites.[1] Hence, it is possible to utilize a composite generally used in the dental office, provided it is indicated to and it is not applied deep within the root canal, where proper light curing would be impossible. The critical material properties for the core build-ups are high filler load, sufficient flexural modulus and flexural strength.

CLEARFIL MAJESTY™ ES-2 composite series (Kuraray Noritake Dental Inc.) are suitable for the case option. Filler load weight percentage of 78 flexural strength of 118 MPa (according to manufacturer), CLEARFIL MAJESTY™ ES-2 Classic corresponds to core build-up prerequisites*. The following case is illustrating the clinical procedure.

* The indication range of CLEARFIL MAJESTY™ ES-2 composite does not cover core build-up. In the specific case it is used for creating a large Class II filling where all conditions from the IFU, such as curing depth, are met.

Fig. 1: Endodontically treated tooth with a verticel fracture of palatal wall on maxillary right second premolar.

Fig. 2: Buccal view of the tooth.

Fig. 3: Clinical image, directly after removal of fragment.

Fig. 4: Fragment of the maxillary right second premolar.

Fig. 5: Circumferential matrix band for build-up to assist endodontic retreatment.

Fig. 6: Build-up of the missing walls (margin relocation) with CLEARFIL MAJESTY™ ES-2 Classic (A3).

Fig. 7: Temporary filling of the cavity while endodontic retreartment.

Fig. 8: Replacement of the temporary filling material with CLEARFIL MAJESTY™ ES-2 Classic.

Fig. 9: Crown preparation.

Fig. 10: Proximal carious lesion present on the adjacent fist premolar.

Fig. 11: Situation after rubber dam placement and caries removal.

Fig. 12: Cavity restored with CLEARFIL MAJESTY™ ES-2 Classic.

Fig. 13: Prepared crown.

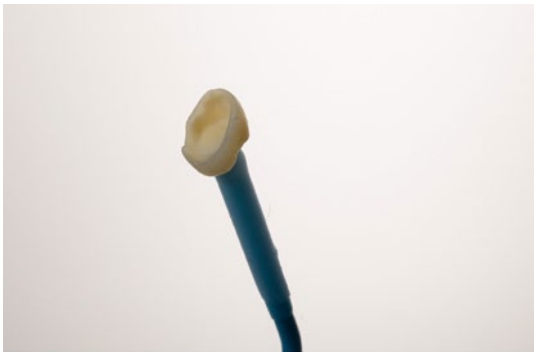


Fig. 14: Crown after sandblasting of the intaglio.

Fig. 15: Mechanically cleaned abutment tooth ready for pre-treatment.

Fig.16: Intaglio of the crown treated with CLEARFIL™ CERAMIC PRIMER PLUS.

Fig. 17: Etching of the composite surface with phosphoric acid gel.

Fig. 18: Air-drying of PANAVIA™ V5 Tooth Primer on the abutment tooth.

Fig. 19: Crown in place after cementation with PANAVIA™ V5 Paste and excess removal.

A good choice

Dual-cure core build-up resin composites are two-component materials that need to be mixed homogeneously, which obstructs composition containing high filler load. However, to prevent deformation of the core, a highly filled composite is advisable. This better simulates, flexural modulus of natural tissues compared to materials with low filler load. Consequently, a light-curing material like CLEARFIL MAJESTY™ ES-2 might be a better option. Applied in 2-mm increments in the core area (and not in the root canal), performs well and provides the desired outcomes. Additionaly, the option of utilising the same material as for any other type of direct restorations is simplifying the storage management and supporting dental practitioners striving for a simplification of clinical procedures.

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COMPREHENSIVE DENTAL REHABILITATION WITH DIGITAL WORKFLOW

ARTICLE BY MICHAEL BRAIAN DDS, CDT, PHD

Digital advancements revolutionized dentistry, providing efficient, precise dental care[1]. Intraoral scanners replace traditional impressions, enabling virtual models for procedures like implant placement, orthodontics, and prosthodontics[2]. Scan bodies aid in digitizing implants, while CAD/CAM improves prosthesis design and fabrication[3]. Milling and 3D printing offer speed, accuracy, and complexity in creating dental prostheses[4]. These innovations promise a bright future for dental professionals and patients.

The integration of digital technologies in dentistry has brought about significant advancements in dental care[1]. This case study presents a comprehensive dental rehabilitation of a patient utilizing a digital workflow, including extraction, dentures, implant surgery, intraoral scanning, 3D printed try-ins, and the fabrication of the final monolithic prosthetic construction.

Extraction of severely decayed teeth

The first step in the patient‘s dental rehabilitation involved the extraction of severely decayed teeth. This procedure was necessary to eliminate the source of infection and discomfort and to prepare the oral cavity for the subsequent steps in the rehabilitation process. Dentures are later used to simplify the guided surgery planning[5]. Following the extraction, the patient was provided with appropriate postoperative care instructions and a healing period was allowed before proceeding with the next steps (Fig.1)

Dentures during the healing period

During the healing period of approximately seven months, the patient was fitted with dentures to replace the extracted teeth. This temporary solution allowed the patient to maintain oral function, appearance, and confidence while the extraction sites healed, and the oral tissues prepared for the implant surgery[6].

Implant surgery

In the upper jaw, six implants were placed, while only four were placed in the lower jaw (Fig.2). This decision was based on the patient‘s individual needs and oral anatomy. Studies have shown that the number of implants required for optimal support and stability depends on various factors, including bone quality and quantity, implant position, and prosthesis design[7]. Research suggests that six implants in the upper jaw and four in the lower jaw are sufficient to provide adequate support for a full-arch fixed prosthesis, with high success rates and patient satisfaction reported[7]. Additionally, placing fewer implants can help reduce surgical time and cost, as well as minimize the risk of complications associated with multiple implant placements. Therefore, this approach was deemed appropriate for this particular patient‘s case.

Fig. 1: Severely decayed teeth prior to extraction.

Fig. 2: Placement of dental implants in the lower jaw.

Fig. 3: Scan bodies used for intraoral scanning.

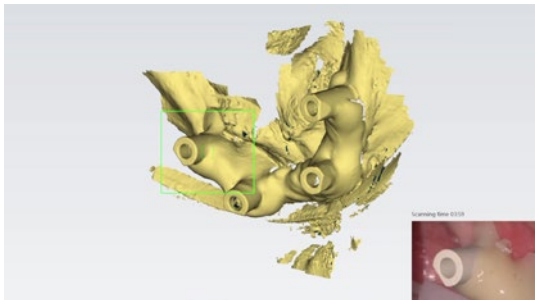

Fig. 4: Splinting of scan bodies in the lower jaw.

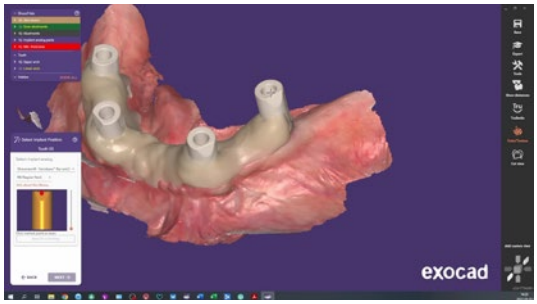

Fig. 5: Intraoral scanning of the implant positions.

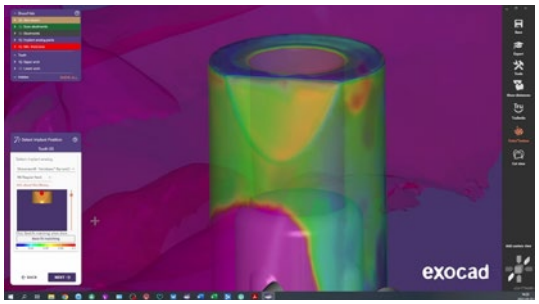

Fig. 6: Digital impression of the patient's oral cavity with scan body alignment in dental CAD software.

Intraoral scanning and digitization

After the implant surgery, intraoral scanning was performed using scan bodies from the implant manufacturer, Straumann. This process accurately digitized the position and orientation of each implant in the patient's mouth. For the lower jaw, Luxatemp was used to splint the single-use scan bodies, simplifying the intraoral scanning process by providing additional geometrical landmarks in an area with fewer natural reference points (Fig.3-5). Intraoral scanning has become an indispensable tool in modern dentistry, providing detailed and accurate digital impressions of patients' oral cavities, replacing the traditional methods involving impressions[2]. Recent research has investigated the accuracy of intraoral scanners for full-arch implant cases, with promising results[8]. One study found that intraoral scanners were comparable to conventional impressions in terms of accuracy and precision when used for full-arch implant cases, with some advantages such as reduced material and labor costs, and faster turnaround times[9]. Additionally, the use of geometrical landmarks, such as scan bodies and splinting materials, can further enhance the accuracy and reproducibility of intraoral scanning[10] (Fig. 6). The digital workflow is particularly advantageous in implant dentistry, as it allows for improved communication and collaboration between dental professionals, laboratories, and patients, as well as providing a more streamlined and efficient treatment process.

3D printed try-ins

Following the digitization of the implants, two sets of 3D printed try-ins were fabricated for both the upper and lower jaws . The first set, known as the “Validator” was designed with gaps between the implant positions (Fig.7). These gaps allowed for the detection of tension when the validator was seated, with fractures occurring in the small gaps if tension was present. This step ensured that the final prosthetic construction would fit accurately and comfortably without undue stress on the implants or surrounding tissues (Fig.8-10).

The second set of try-ins was used to check various factors, including aesthetics, occlusion, bite height, hygiene capabilities, phonetics, and function. This “final try-in” closely resembled the ultimate prosthetic construction and was used to make any necessary adjustments before fabricating the final restoration (Fig.11,12). In this case the validator did not break, and we did not need to make any changes to the validator. If the validation had broken the operator would have had to splint the broken segments with composites, unscrew the construction and send it back to the laboratory for precision scanning. If the operator needs to change the occlusion or adjust anything on the try-in, a new intra oral scan is made so that the technician can adjust accordingly.

Both the validators and the try-ins are med on Titanium bases from the manufacturer. Furthermore it is possible to use the validators as both a validation of fit and all other checks as for the try-ins reducing the need for two different sets. The same procedure is possible to do for bridge base constructions minimizing the de-cementation risk of titanium bases.

Fig. 7: 3D printed “Validator” try-in with gaps between implant positions. The Validator has the exact same design as the try-in, with the only difference being that the Validator has been cut between the implants using a virtual disc cutter and the attachment function in Exocad.

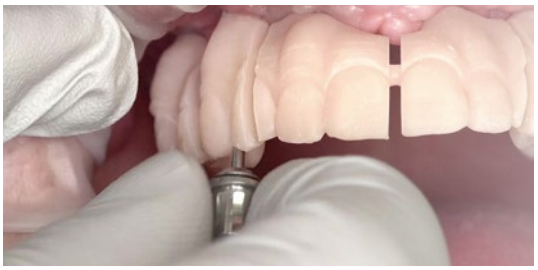

Fig. 8: Validator try-in seated in the patient’s mouth. It is crucial to ensure that the titanium base or bar bridge is firmly seated within the Validator, which can preferably be achieved using resin cement. The Validator should be retained with the same torque as the manufacturer recommends for the final reconstruction.

Fig. 9: Fractured Validator try-in indicates tension. If a fracture is present, the practitioner needs to identify and locate the source of the misfit. They should then attach the separated parts using composites, remove the validator, and send it back to the lab for precision scanning.

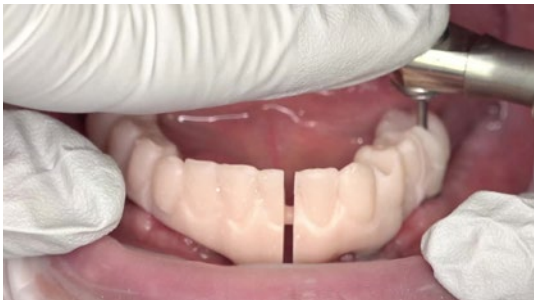

Fig. 10: Adjusted Validator try-in without fractures in the lower jaw.

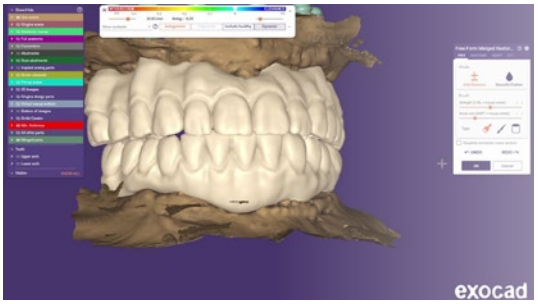

Fig. 11: Final try-in in CAD software.

Fabrication of the final prosthetic construction

Once the validators and try-ins were successfully controlled, the final prosthetic construction was fabricated using the same features and specifications as the try-ins (Fig.12). This step ensured that the final restoration would accurately represent the validated try-in, providing a comfortable, functional, and aesthetically pleasing result for the patient. In this step it is important to use a material that has the aesthetic features and material properties to be manufactured in full anatomy as a monolithic reconstruction[11]. Studies have shown that monolithic zirconia prostheses exhibit high fracture resistance and excellent long-term clinical performance, making them a suitable material choice for full-arch fixed implant-supported prostheses.[12] A fully digital workflow requires the user to validate intra-orally and then adjust the initial CAD design accordingly and verify that whatever is designed is shown as close as possible in the manufacturing process (Fig.13,14). If the technician were to add veneering material or in any other way change key morphological parts of the reconstruction the digital workflow will be less reliable.

Material selection, cementation and staining

In this case, the final prosthetic construction was fabricated using monolithic KATANA™ Zirconia YML from Kuraray Noritake Dental Inc.. This high-quality material offers excellent strength, durability, and aesthetics for dental restorations.

The staining process was performed using CERABIEN™ ZR FC Paste Stain from Kuraray Noritake Dental Inc. to achieve a natural appearance and blend seamlessly with the patient‘s existing dentition.

PANAVIA™ V5 Paste Opaque and CLEARFIL™ CERAMIC PRIMER PLUS was used to cement Elos Accurate® Hybrid Base H™ Non-Engaging, compatible with Straumann Standard and Standard Plus 4.8 RN. (Fig.15-22).

Fig. 12: The patient is wearing the final try-in. One important consideration is to avoid using the OptraGate retractor when checking the bite. The retractor affects muscular activity and could negatively impact the validation process. In this image, the OptraGate is used to simplify the photography process.

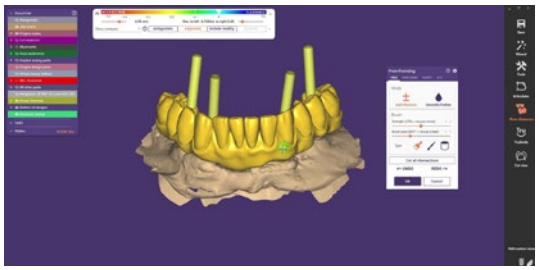

Fig. 13: CAD of the lower jaw reconstruction.

Fig. 14: Try-in of the lower jaw reconstruction.

Fig. 15: CAD view of the designed reconstruction in correlation with the patient’s smile.

Fig. 16: Cementation of Elos Accurate® Hybrid Base H™ Non-Engaging with PANAVIA™ V5 Paste Opaque and CLEARFIL™ CERAMIC PRIMER PLUS.

Fig. 17: The final reconstruction at the day of delivery.

Fig. 18: Fully monolithic KATANA™ Zirconia YML from Kuraray Noritake Dental Inc..Stained using CERABIEN™ ZR FC Paste Stain from Kuraray Noritake Dental Inc.. The dark gingiva spots are stained with "Red" the light pink surfaces with "Pink" and the highlight with "Salmon Pink".

Fig. 19: Final reconstruction right side view. The cervical parts are stained with "Cervical 2" the incisal two thirds of the anteriors with "Grayish Blue" and the mamelones with "Mamelon Orange 1".

Fig. 20: Final reconstruction left side view.

Fig. 21: Final reconstruction upper jaw occlusal view.

Fig. 22: Final reconstruction lower jaw occlusal view.

Conclusion

This case study demonstrates the successful application of digital workflow in a comprehensive dental rehabilitation involving extraction, dentures, implant surgery, intraoral scanning, 3D printed try-ins, and the fabrication of a monolithic zirconia prosthesis. The integration of digital technologies in dentistry has significantly improved the efficiency, precision, and outcomes of dental treatments, resulting in enhanced patient care and satisfaction. As technology continues to advance, it is expected that digital dentistry will continue to evolve, offering even greater possibilities for dental professionals and patients alike.

Michael Braian DDS, CDT, PhD
Michael has dedicated his entire professional life to the field of prosthetic dentistry. He began his dental technology education at Malmö University in 1999 and has since graduated as both a dental technician and dentist. In 2018, he defended his doctoral thesis in digital dentistry. For the past fifteen years, Michael has focused exclusively on digital solutions in dentistry. In 2014, he fulfilled his dream of starting a private practice where he works as both a dentist and dental technician, allowing him to oversee the entire process from start to finish on all patient cases. Michael has won several awards for his pedagogical skills and is constantly engaged in expanding his knowledge in the field of prosthetic dentistry. Michael is the founder of the Swedish organisation for computer aided digital dentistry SWECADD.

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STUNNING AESTHETICS

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ADVANTAGES

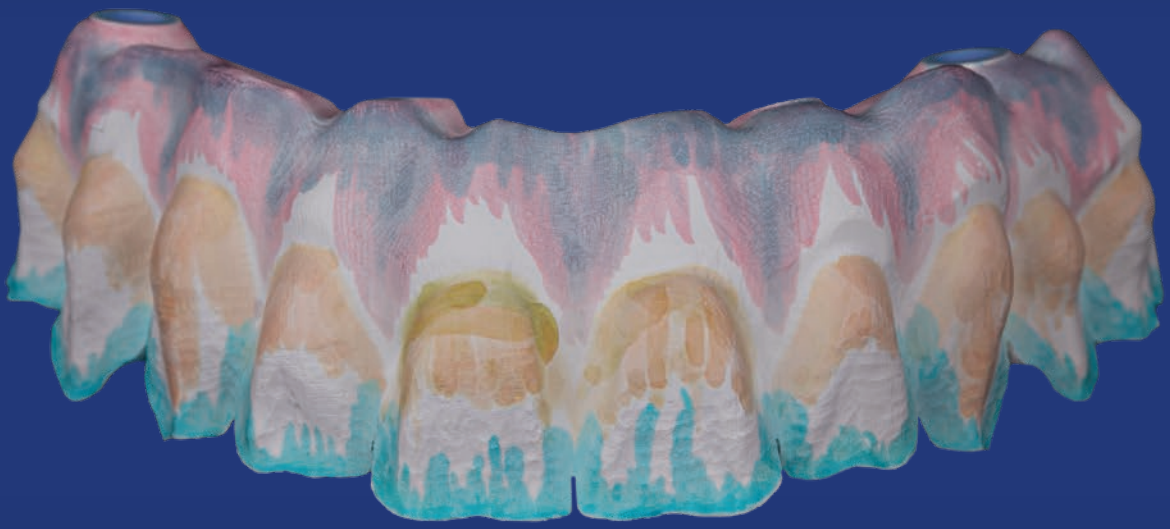
- Consistent performance
- Pure aesthetics
- Easy to use
- Controlled finalisation

SCAN ME

PATH TO PERFECTION

10 YEARS OF MULTI-LAYERED ZIRCONIA

ARTICLE BY MATHIAS FERNANDEZ Y LOMBARDI AND GIULIANO MOUSTAKIS



In the past ten years, work procedures in the dental laboratory have changed dramatically. New manufacturing technologies have established themselves and materials have evolved. Among them are multi-layered zirconia variants. In 2013, the company Kuraray Noritake Dental Inc. (Tokyo, Japan) introduced the first multi-layered zirconia – KATANA™ Zirconia. Using the KATANA™ Zirconia family as an example, the authors provide an overview of different types of zirconia, raw material quality, material competence and finishing methods.

Mathias Fernandez Y Lombardi

Giuliano Moustakis

Indices
Zirconia, micro-layering, staining, aesthetics

Introduction

No matter whether single crown, long-span bridge, complex implant-based restoration or veneer – zirconia has established itself as an all-rounder material for all-ceramic dental restorations. Its evolution still seems to be far from complete, zirconia variants and procedural paths are being further optimized and adapted to the needs of modern prosthetic dentistry. Before a material like zirconia finds full acceptance among users, however, obstacles have to be overcome. Dental technicians in particular are often said to have a drive for perfectionism; well aware that there can be no such thing as a "perfect imitation" of natural teeth. Even the smallest light-optical subtleties of an all-ceramic restoration can prevent the trained eye of an experienced dental technician from accepting the work outcome and thus also the material as a success.

Japanese craftsmanship as the basis for innovative materials

It is not only in Germany that dental technology as a craft combines – in addition to technical know-how – qualities such as passion, inquisitiveness and perseverance with the pursuit of perfection. Also in Japan, traditional dental technology is subject to the demand for perfection in its excellence and precision. Digital manufacturing technologies do not alter this intention. In Japan, dental ceramic craftsmanship is highly respected. Many Japanese master dental technicians are renowned worldwide for their manual skills. Their perfectionism and passion for what they do are virtually unique. The development of ceramic materials by the Japanese company Kuraray Noritake Dental Inc. is also based on this inspiring source. Among other things, groundbreaking milestones have been set with the multi-layered zirconia of the KATANA™ Zirconia family (Figs. 1 and 2). The company attributes every step on the path to perfection to its own competence. Intuition, skill and precision characterize research and development. The focus is always the same: continuous development of materials in order to constantly improve products, to pass on know-how and to perfect the combination of tradition and innovative technologies day by day.

Dental technicians in particular are often said to have a drive for perfectionism; well aware that there can be no such thing as a "perfect imitation" of natural teeth.

Fig. 1 and 2: Exemplary presentation of anterior restorations made of KATANA™ Zirconia Multi-Layered (Kuraray Noritake Dental Inc.).

Overview of different zirconia variants

Basically, zirconia variants differ in their mechanical and optical properties. For easier distinction, they are often referred to as generations [6, 7].

- 1st generation: 3Y-TZP zirconia
  - Properties: high opacity, high flexural strength (approx. 1,200 to 1,500 MPa)
  - Application: frameworks for the veneering technique

- 2nd generation: 3Y-TZP zirconia (modification on molecular level)
  - Properties: improved translucency, high flexural strength (approx. 900 to 1,200 MPa)
  - Application: frameworks for veneering, cut-back frameworks, possibly monolithic restorations
  - Products: KATANA™ Zirconia HTML Plus, HT (HT = High Translucent, ML = Multi-Layered) (Fig. 3)

- 3rd generation: 5Y-TZP zirconia (approx. 50 % cubic phase content)
  - Properties: very high translucency, lower flexural strength (approx. 400 to 900 MPa)
  - Application: monolithic restorations up to 3-unit bridges (up to premolar region) and frameworks for micro-layering
  - Product: KATANA™ Zirconia UTML (UT = Ultra Translucent, ML = Multi-Layered) (Figs. 4a and b)

- 4th generation: 4Y-TZP zirconia (approx. 30% cubic phase content),
  - Properties: high translucency, lower flexural strength (approx. 600 to 1,000 MPa)
  - Application: monolithic restorations (anterior and posterior) and frameworks for micro-layering
  - Product: KATANA™ Zirconia STML (ST = Super Translucent, ML = Multi-Layered) (Fig. 5a and b)

- Progressive multi-generation discs: Layer-combination of 4Y-TZP and 5Y-TZP
  - Properties: translucency and flexural strength gradation
  - Application: All-rounder (monolithic restorations and frameworks for micro-layering).
  - Product: KATANA™ Zirconia YML (Fig. 6)


3


4a


4b


5a


5b

Fig. 3: Framework for long-span restoration made of KATANA™ Zirconia HTML Plus, a zirconia variant with a high stability, yet high translucency.

Figs. 4a and b: Single crowns made of KATANA™ Zirconia UTML, a zirconia variant with an ultra-high translucency.

Figs. 5a and b: Single crowns with an anatomically designed framework made of KATANA™ Zirconia STML – a zirconia variant with a high translucency – and a layer of porcelain.

Milestone: Multi-layered zirconia

Launched by Kuraray Noritake Dental Inc. in 2013, multi-layered (ML) zirconia is now well established and offered by various manufacturers (Fig. 7). With the introduction of KATANA™ Zirconia ML ten years ago, Kuraray Noritake Dental Inc. heralded a paradigm shift. Despite its high translucency, this type of zirconia exhibits a sufficiently high flexural strength of approx. 1,000 MPa. Its advantages became highly relevant, especially for monolithic use, due to the availability of multi-layered technology [4]. However, since the translucency of the zirconia did not yet match that of glass-ceramics, the development continued. The next big step forward came in 2015. Two translucent materials were added to the KATANA™ Zirconia family. In KATANA™ Zirconia UTML (Ultra Translucent), the yttria content was increased. The ceramic is stabilized more than 50 % in the cubic phase. Translucency increases due to the high share of cubic phase. At the same time, however, the flexural strength is reduced. For this reason, research and development went further and partly back to materials with higher flexural strength values (KATANA™ Zirconia STML, Super Translucent) (Fig. 8).

6

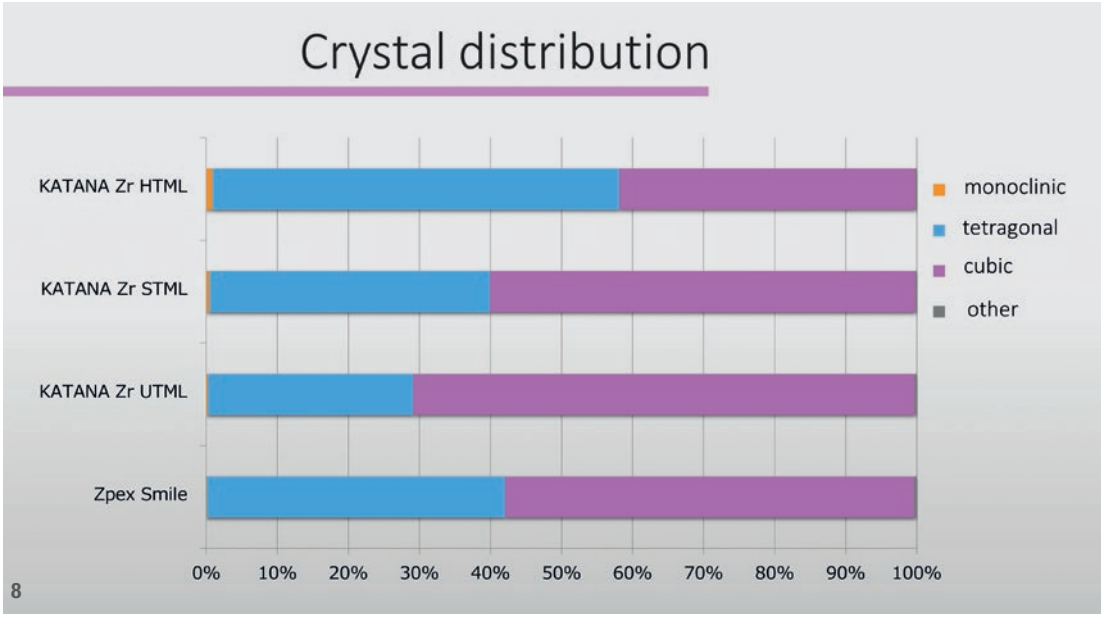
Fig. 6: Long-span bridge framework made of KATANA™ Zirconia YML, a zirconia variant with colour, translucency and flexural strength gradation – an allrounder material for universal use.

Fig. 7: Overview of the KATANA™ Multi-Layered family.

Fig. 8: Schematic representation of different types of zirconia and their phase content (source: IADR 2017, Dr Masano Inokoshi, Tokyo University).

7

The latest development on the market is multi-generation zirconia. With this type, brightness and translucency of the multi-layered discs are controlled not only by the powder-shade formulations (yellow, pink, grey, white), but also by combining different generations of zirconia.



8

Milestone: Multi-generation zirconia

The latest development on the market is multi-generation zirconia. With this type, brightness and translucency of the multi-layered discs are controlled not only by the powder-shade formulations (yellow, pink, grey, white), but also by combining different generations of zirconia. Simply put, the best of all generations is combined in one blank. KATANA™ Zirconia YML (Kuraray Noritake Dental Inc.) (Fig.9) is an example [1]. This material has successfully established itself since its market launch in 2021. Multi-generation zirconia offers a high degree of application versatility. Almost any type of fixed restoration can be implemented, as strength and translucency are harmoniously matched (image YML Restoration). Example: they offer high flexural strength in the dentin area and high translucency in the enamel area – thanks to these features, KATANA™ Zirconia YML can be used for every all-ceramic application. Theoretically, the dental laboratory can do without other ceramic CAD/CAM materials in the laboratory.

The basis for material quality

Users of zirconia are spoiled for choice these days. Countless manufacturers offer zirconia materials, and at first glance, it is hardly apparent that the blanks differ in terms of quality. Basically, the quality of the materials depends on the quality of the raw material and is also affected by raw material processing. Processing has a major impact on the surface quality, edge stability, accuracy of fit and processing requirements of the milled restorations (Fig. 10).

Raw material production

Pre-shaded zirconia usually consists of metal oxides (including zirconia, yttria and alumina) and additives such as binders and colour pigments or ions. Most manufacturers of dental zirconia purchase prefabricated powder from an external supplier. In contrast, Kuraray Noritake Dental Inc. relies on a coordinated production process that is carried out in-house from start to finish (Fig. 11).

The process includes the production and adding of components forming the company‘s multi-layered technology. Since more production steps are carried out in-house, the company maintains full control over the quality of the raw materials, the particle distribution and the purity of the formulation. This allows for a precise adjustment of the mechanical and optical product properties. Properties of zirconia restorations that depend on the quality and composition of the powder include translucency and colour impression, flexural strength, aging behaviour and sintering performance.

9

Fig. 9: Framework made of a multi-generation zirconia material (KATANA™ Zirconia YML).
Fig. 10: The quality of the material has an impact on surface quality, edge stability, accuracy of fit and processing requirements of the milled restorations.
Fig. 11: The company Kuraray Noritake Dental Inc. employs a well-aligned production process carried out in-house. Hence, it keeps full control over the quality of the raw materials, their particle size and the purity of the formulation.

10

11

Block pressing

Zirconia for CAD/CAM machining is usually produced by uniaxial and isostatic pressing.

- Uniaxial compaction process
  Pressure is applied to the powder from one (uniaxial) direction or from two (biaxial) directions.

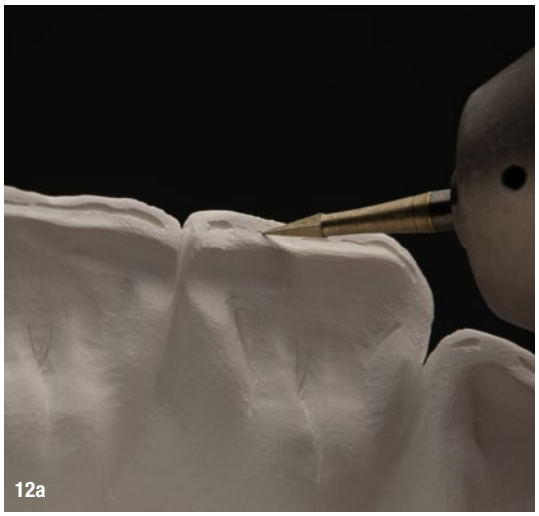
- Isostatic compaction process
  Virtually equal pressure is applied from all sides.

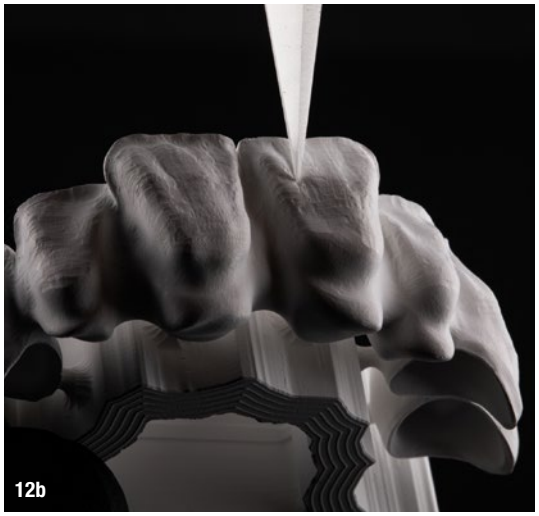
Isostatic pressing usually results in a more uniform density distribution throughout the blank and a higher homogeneity of the material. These factors are prerequisites for a predictable processing and sintering behaviour.
For optimum mechanical and optical properties, it is crucial to avoid large pores, air pockets and impurities. These occur when airborne particles are trapped in the block during pressing. At Kuraray Noritake Dental Inc., a uniform pressure distribution is achieved through a meticulous pressing process, which also provides for a low risk of contamination from airborne dust. In this way, the special process contributes to the highest possible density of the zirconia. All the procedural steps that are meticulously carried out – from raw material production to pressing - are responsible for the high edge stability and surface quality of the restorations made of KATANA™ Zirconia.

Presintering

Industrial presintering is required to give stability to the pressed zirconia blanks. The temperature profile and the duration of the presintering cycle determine the strength and processing properties. The blanks resulting from the special presintering process used in the in-house procedure of Kuraray Noritake Dental Inc. are highly stable. Despite this stability, KATANA™ Zirconia can be machined with standard diamond-coated milling tools without an increased risk of breakage or tool wear.
An additional advantage is that, due to the higher strength of KATANA™ Zirconia in its green state, a more accurate processing is possible (Figs. 12a to c). For example, the use of the carving technique is feasible without any problems. Characteristics such as marginal stability or accuracy of fit are also positively affected.

All the efforts to produce a zirconia material of the highest quality make the difference. The multi-layered KATANA™ Zirconia family is characterized by a homogeneous, high-density structure with low porosity and a high degree of purity. And the path to perfection continues.





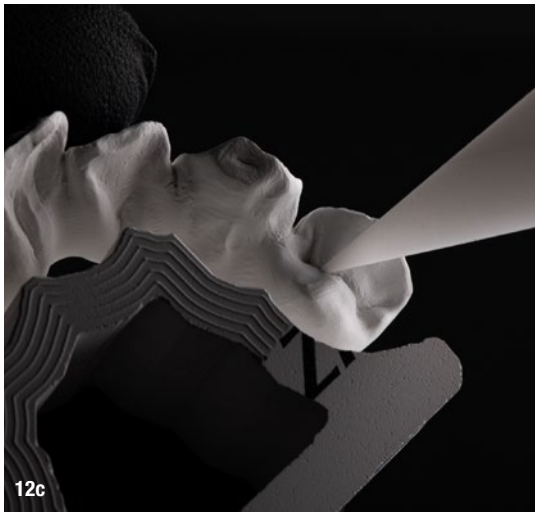


Fig. 12a: Processing of a zirconia framework in its green state (prior to sintering) with rotary instruments.
Figs. 12b and c: Carving technique: Processing of a zirconia framework in its green state (prior to sintering) with a scalpel.

Figs. 13a to c: Micro-layering on a zirconia framework.

Milestone: the next quench to aesthetics

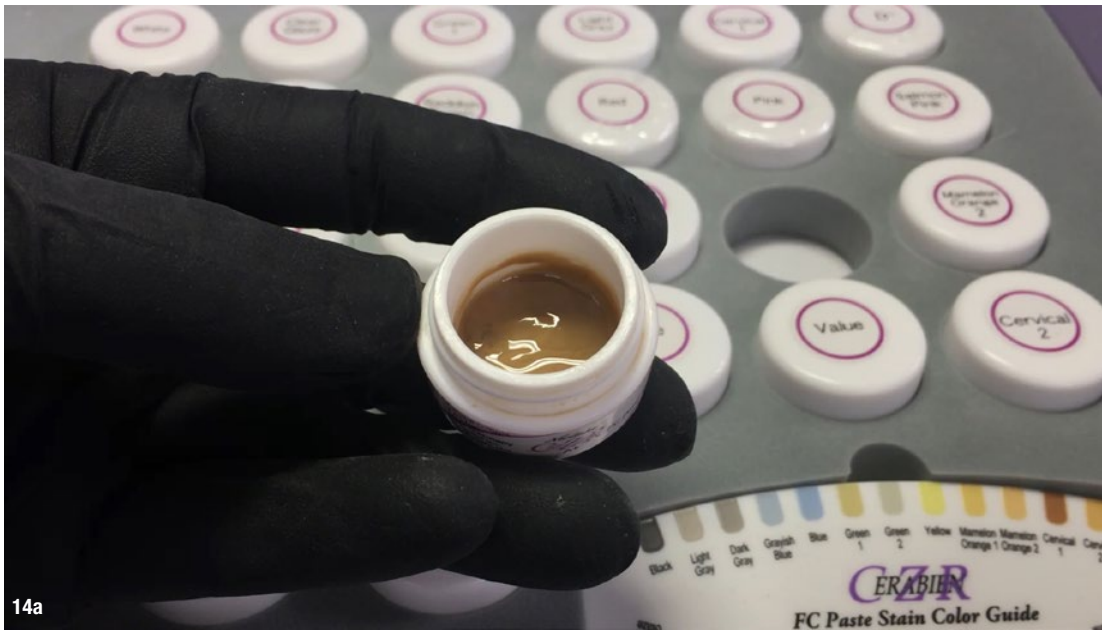
Translucent multi-layered zirconia variants have natural light-optical properties. If indicated, they may be used to realize monolithic restorations that are optically close to a veneered restoration. In many cases, however, additional measures are taken to achieve aesthetic optimization of zirconia restorations made of translucent zirconia by applying a thin layer of ceramic or stain. This is mainly due to the demand for aesthetic perfection in dental technology.

Esthetic Colorant is applied – prior to sintering – to the original multi-layered zirconia KATANA™ Zirconia to intensify light optical properties without affecting the material properties.

Micro-layering and internal stain

Popular today under the name of micro-layering, the application of a thin layer of porcelain after cut-back has been used for some time (Figs. 13a to c). A highly natural appearance can be imitated for example through internal staining of an anatomically reduced framework and subsequent porcelain layering. The technique originated in Japan and is now known and popular worldwide under the name “internal stain technique”.

The porcelain system CERABIEN™ ZR (Kuraray Noritake Dental Inc.) contains specific Internal Stains, which allow for an easy implementation even of complex layering concepts [3, 5].



14a

External stains or liquid ceramic system

The external staining technique is also evolving. Traditionally, dental technicians have been accustomed to applying ceramics in layers to achieve a vivid depth effect. Nowadays, monolithic designs and the staining technique have also become established. Translucent or multi-layered zirconia material provide a suitable basis for this technique. Even in the anterior region, it is possible to create restorations with adequate aesthetics. Manufacturers like Kuraray Noritake Dental Inc. have developed ceramic-based stains for characterisation, which are often referred to as “liquid ceramics”. In the true sense of the word, these materials are ceramic-based stains (CERABIEN™ ZR FC Paste Stain, Kuraray Noritake Dental Inc.), which are used to give the monolithically milled restorations a vivid depth effect with a 3D appearance by means of a millimetre-thin structural layer [5] (Figs. 14a and b and 15a and b).

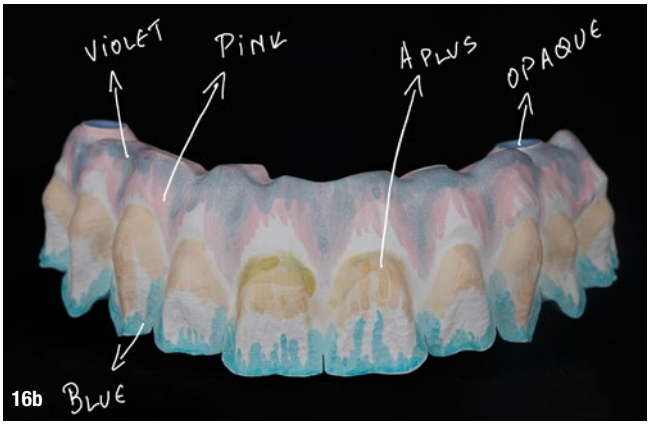

14b


15a


15b

Figs. 14a and b: Ceramic-based stains (CERABIEN™ ZR FC Paste Stain, Kuraray Noritake Dental Inc.) for a vivid depth effect. **Figs. 15a and b:** Anterior restoration finished with ceramic-based stains (CERABIEN™ ZR FC Paste Stain).

16a



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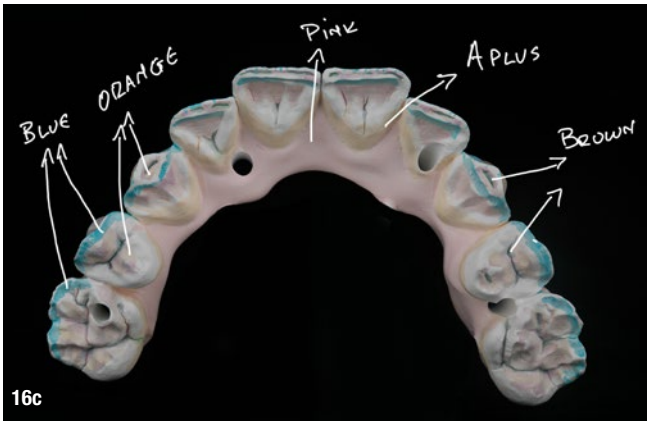

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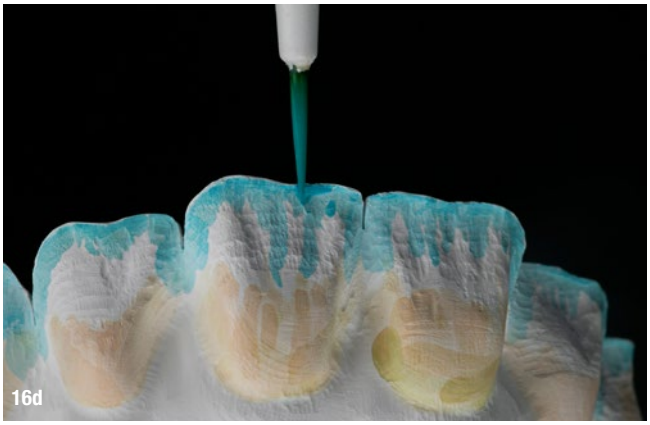
16d

Fig. 16a: Effect liquids (Esthetic Colorant) for dyeing and characterisation of pre-sintered zirconia.
Fig. 16b to e: Application of Esthetic Colorant onto the zirconia framework (prior to sintering) based on a colour map. The light-optical properties of the zirconia are intensified.

Milestone: effect liquids for intensification of the multi-layered structure

The path to perfection goes on and on. In the summer of 2022, after intensive development work, Kuraray Noritake Dental Inc. launched special effect liquids (Esthetic Colorant) for colouring and characterizing pre-sintered zirconia (Figs. 16a to e). Esthetic Colorant is applied – prior to sintering – to the original multi-layered zirconia KATANA™ Zirconia to intensify light optical properties without affecting the material properties [2]. Esthetic Colorant is intentionally not over-saturated in colour intensity. Since the liquids are applied to pre-shaded zirconia, the product range does not include any basic shades as known from classical dyeing liquids. Rather, the less saturated shades allow the already highly aesthetic zirconia (KATANA™ Zirconia) to "breathe" and hence develop its full translucency. Perfected for modern high-translucency zirconia, Esthetic Colorant creates individual effects on a case-specific basis even before sintering.

In this context, another aspect is gaining importance. Since zirconia is becoming increasingly translucent and beautiful, it is necessary in some cases (e.g. when the abutment is discoloured) to mask the framework. Ideally suited for masking on cubic zirconia is Esthetic Colorant OPAQUE. Due to the smartly composed chemistry behind it, it was even possible to integrate a penetration stop so that the colour is not completely diffused into the green state zirconia. In this way, the original translucency is maintained.

16e

Outlook into the near future

Over the past ten years, zirconia has evolved rapidly. Work in dental laboratories has changed a lot since Kuraray Noritake Dental Inc. introduced the first multi-layered zirconia in 2013. Apart from the continuous evolving of dental materials, processing technologies have improved enormously. Nowadays, it is theoretically possible to produce ceramic restorations with high aesthetics and individual functional criteria in a completely automated process. It is foreseeable that the monolithic realization of zirconia restorations will continue to gain acceptance. This efficient production method offers many advantages with regard to the fulfilment of economic requirements. Unaffected by the economic advantages, however, the demand for high aesthetics – the desire for perfection – remains. Modern multi-layered zirconia variants such as the KATANA™ Zirconia family provide the basis for meeting these demands as well. In addition, efficient finishing materials (e.g. Esthetic Colorant, CERABIEN™ FC Paste Stain) play an important role. And so, the path to perfection is pursued further – both in dental laboratories and dental practices and in the dental industry; always with the aim of being able to provide the patient with the best possible solution. For the company Kuraray Noritake Dental Inc., efficiency in everyday laboratory work is of great importance. Therefore, the company follows the aim of offering materials and products that simplify everyday work procedures, so that the desired outcomes can be achieved with less effort and more efficiency.

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COPYING NATURE WITH HIGH-PERFORMANCE MATERIALS

ARTICLE BY GHAITH ALOUSI

What does it take to reconstruct teeth according to the patient's individual sense of beauty? Experience shows that copying nature is the secret of success. To become a good duplicator, it is essential to develop an eye for detail with regard to tooth forms, surface morphology and the internal colour structure of the teeth to be copied. In addition, the duplicator needs to develop an understanding of the materials and tools used to copy those details. The last key success factor is taking pleasure in interacting with patients.

Practicing on large tooth forms

How to develop those skills? A good option is practicing on large tooth forms. Their size makes it easy to concentrate on the contour and surface morphology, while it simplifies analysis and a final evaluation. For the latter purpose, the use of silver or gold powder applied to the surface has proven its worth, as it reveals every detail. Once satisfied with the outcomes on the models, the user can move on to work on real restorations. This approach is suitable both for beginners and experienced users working with new dental materials and instruments, as it leads to a true understanding of their features and behaviour during use.

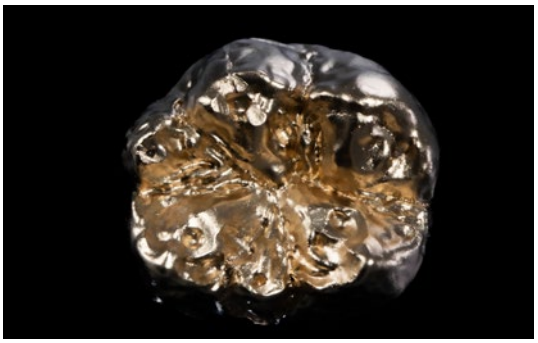


Fig. 1: Large tooth form with a detailed occlusal surface morphology revealed with gold powder.

Choosing concepts and materials

Which materials and techniques to choose for copying? This definitely depends on personal preferences. It is a fact that the high-translucency, pre-shaded zirconia materials available today enable simplified porcelain layering techniques. For certain patients, they work well even without an additional layer of porcelain. My materials of choice are KATANA™ Zirconia Multi-Layered, Esthetic Colorant and CERABIEN™ ZR. Using them in a One-Bake approach allows a dental technician to reproduce a natural shade and interplay of colours, as shown in the following using two patient cases. The major benefit: the time saved in the firing and finishing steps can be invested in layering to create a truly individual and lifelike outcome.

CASE 1:
SINGLE ANTERIOR CROWN ON AN IMPLANT

This female patient had an implant placed in the region of her maxillary left central incisor. It was planned to restore the missing tooth with a custom abutment made of zirconia and a zirconia crown. In order to evaluate the internal colour structure of the patient's teeth and the tooth form, I invited the patient to come to the laboratory. Colour analysis showed that this patient has a highly complex colour structure. Based on the findings, KATANA™ Zirconia STML in the shade A3 was chosen as a framework material. It is best suited to replicate the basic colour of the tooth as well as the translucency in the incisal area.

The zirconia core was planned and manufactured in an anatomically reduced design for full porcelain layering. Due to the complexity of the patient's inner tooth structure, the framework was characterized with Esthetic Colorant for KATANA™ Zirconia. These dyeing liquids work like internal stains, but are applied to the milled element prior to sintering. The marginal ridges were highlighted with Blue, the incisal edge with Blue and Orange. For the margin and the body area, A Plus was used to increase the chroma. Figure 5 shows the zirconia core before and after sintering.

Fig. 2: Initial situation: Patient with the custom implant abutment in place.

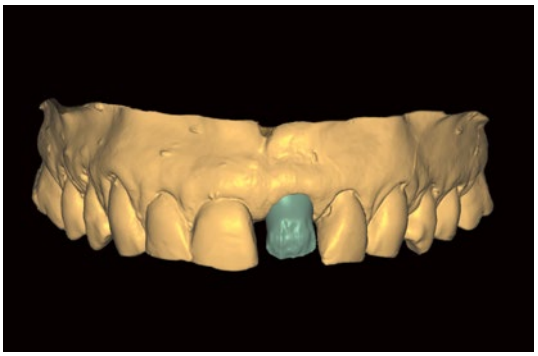


Fig. 3: Computer-aided, anatomical framework design.

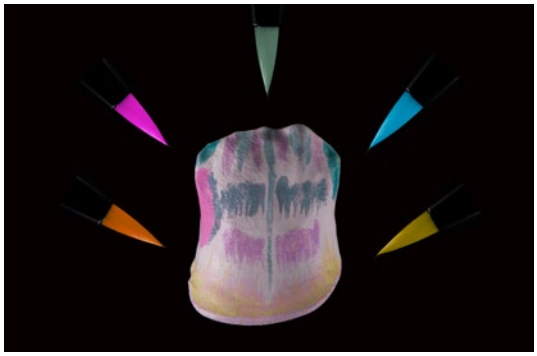


Fig. 4: Colour map for Esthetic Colorant.

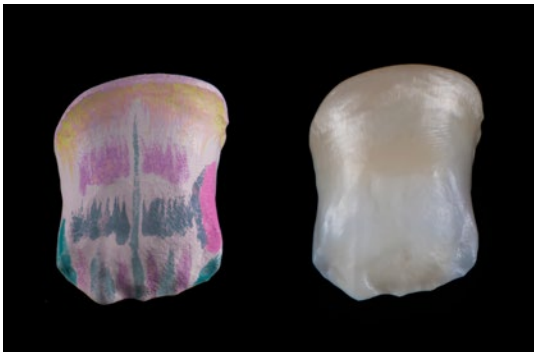


Fig. 5: Zirconia core before and after sintering.

Fig. 6: Porcelain layering with A3.5B and D3B in the body plus LT Coral ...

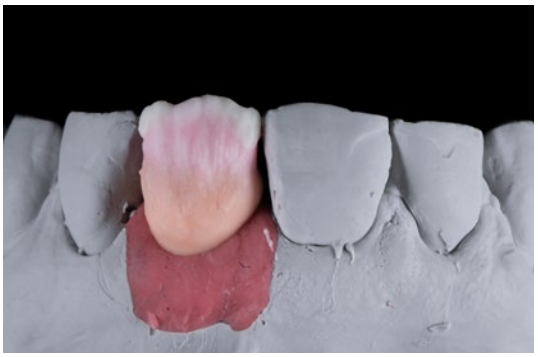


Fig. 7: … and Super Gray in the incisal area.

After sintering, the patient presented in the laboratory again for try-in and evaluation of the zirconia core, which already matched her tooth colour very well. Due to these preparatory measures, it was possible in the present case to opt for the preferred One-Bake Technique. Different porcelains were used for the following finishing procedure: A3.5B and D3B were applied in the body area, while a combination of LT Coral and LT Super Gray was used in the incisal area. Then, the mamelons were created with a mixture of Sunbright Mamelon 2 and CCV 2. A thin layer of TX was applied on top. While in the distal area, E3 and LT Super Gray were added, CCV 4 and Creamy Enamel were applied in the cervical area. A thin final layer of Clear completed the process. What followed was the contouring and mechanical polishing of the surface. After the bake, some external stains were applied and the surface was polished again (no glaze applied). Figure 11 shows the final restoration, figure 12 the treatment outcome.

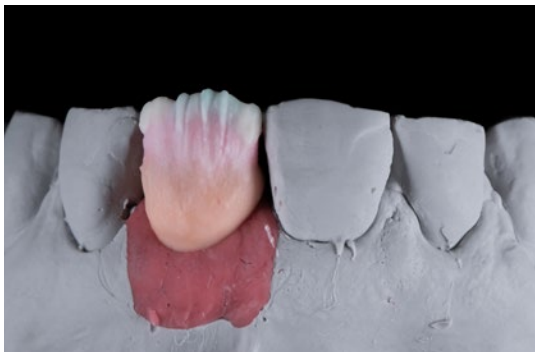


Fig. 8: Build-up …

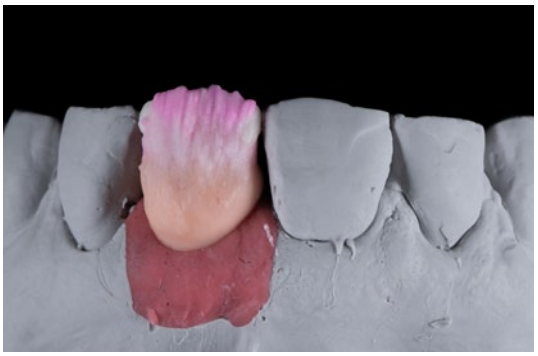


Fig. 9: … of the mamelons.

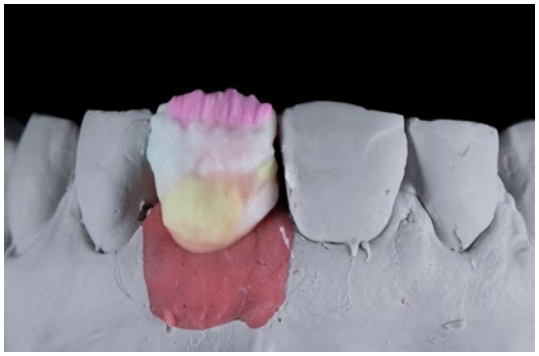


Fig. 10: Porcelain layering completed.

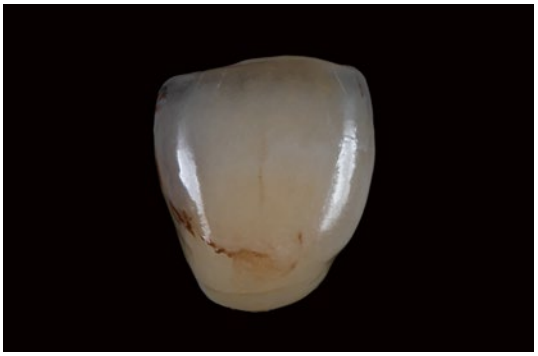


Fig. 11: Crown after firing and characterization with external stains.

Fig. 12: Treatment outcome.

CASE 2:
FOUR ANTERIOR CROWNS WITH A VESTIBULAR LAYER OF PORCELAIN

In this case, a male patient with severe bruxism needed a replacement of his existing restorations on the maxillary incisors. The idea was to restore all those teeth with four zirconia crowns. During the patient's initial visit in the dental laboratory, we found that one of his abutment teeth (the left central incisor) was heavily discoloured.

Due to the increased stability demands, the selected framework material was KATANA™ Zirconia YML, which has a high translucency in the incisal area, but a particularly high strength in the body part. The decision to opt for a porcelain layer limited to the vestibular area only was also guided by the patient's parafunctional behaviour.

The crowns were designed in full contour with an anatomical reduction in the vestibular area. As the precise reproduction of the natural play of colours and translucencies is not easy in just a thin layer porcelain, the support of Esthetic Colorant for KATANA™ Zirconia was particularly valuable in this case. After milling, it was applied to the outer surface of the restorations for individual internal staining effects. In addition, the modifier liquid Esthetic Colorant OPAQUE was applied to the intaglio surface of the crown produced for the discoloured left central incisor. OPAQUE is one of two modifier liquids (the other is WHITE) specifically developed for a masking of the abutment colour from the inside of the restoration, while leaving the translucency of the outer part of the zirconia unaffected. After drying of the restorations, they were sintered according to the standard schedule (seven hours).

Fig. 13: Prepared teeth after removal of the old restorations.

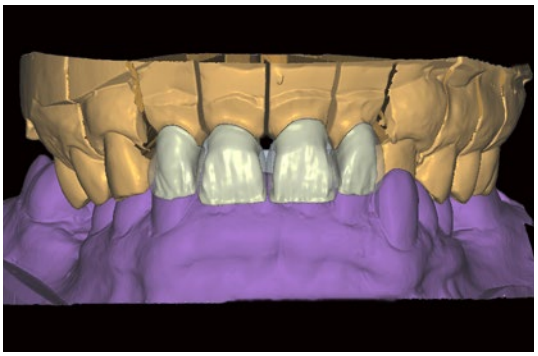


Fig. 14: Computer-aided design of the zirconia structures.

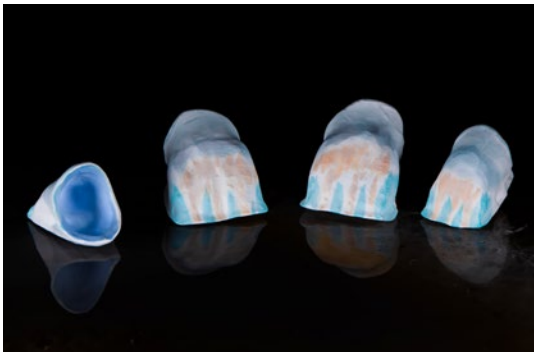


Fig. 15: Esthetic Colorant applied to the inside and the outside of the zirconia structures.

Fig. 16: Outcome of the final sintering procedure.

Fig. 17: Framework try-in and colour evaluation.

The zirconia frameworks were tried in in the laboratory to check the colour. It matched the colour of the adjacent teeth very well, so that it was possible to proceed with the One Bake Technique. In this case, CERABIEN™ ZR porcelain in the colour A3.5B was used for the body part, while the luster porcelains LTX, Sunbright, LT1, CCV4 and Aqua Blue 1 were the porcelains of choice for the individualization of the other areas. The final, very thin layer was created with T Clear. After contouring, the surface was mechanically polished. The treatment outcome is shown in figures 19 and 20.

Fig. 18: Porcelain layering.

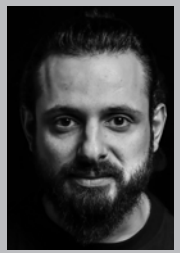
Conclusion

Listening to patients, interacting with them during different phases of the treatment and perceiving the important details of tooth form, surface morphology and colour are skills which are decisive for everyone who would like to copy nature as precisely as possible. This approach opens the way to truly individual restorative treatments.

Fig. 19: Treatment outcome.

The cases presented here reveal that opting for careful planning, a versatile technique and customized layering schemes that are adjusted to the needs of each patient allows for high-quality outcomes – even if the space available for truly individual features is small. For me, a key success factor is the use of high-performance materials, which I found in KATANA™ Zirconia, CERABIEN™ ZR and the new Esthetic Colorant after having gained experience with many different zirconia restoration systems.

Fig. 20: Appearance of the patient.



DT Ghaith Alousi

Ghaith Alousi successfully completed his training as a dental technician in his hometown Damascus (Syria) in 2013. At the same city, he was able to gain initial professional experience. When he came to Germany in 2016, he started working as a dental technician in a laboratory in Wiesbaden and attended diverse continuing education courses mainly in the field of porcelain layering and the imitation of nature. Currently, he is responsible for a wide range of activities: Tooth shade determination, try in of frameworks in practice and laboratory, photography and documentation, CAD/CAM implant work, veneers, crowns, bridges inlays and onlays. He enjoys working with patients and staying in touch with dentists to achieve the best results.

KATANA™ Zirconia YML

EMPOWER YOUR DENTAL LAB

MULTI LAYERED

DISCOVER NEXT EVOLUTION MULTI-LAYERED

This innovative raw material combination of highly translucent zirconia with high strength will empower your dental lab. "KATANA™ Zirconia" YML delivers efficiency, clarity, simplicity and precision in handling without compromising the quality of the outcome!

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SCAN ME

10 YEARS KATANA™ Zirconia MULTI-LAYERED SERIES:

A BRAND AND ITS REPUTATION IN THE DENTAL INDUSTRY

Photo credits to Giuliano Moustakis

Can you imagine a world without multi-layered zirconia? The invention of a zirconia material with natural colour gradation and well-balanced translucency and strength led to fundamental changes in the way zirconia-based restorations are produced. When the first product of its kind – KATANA™ Zirconia ML – was introduced to the dental market exactly ten years ago, dental technicians all over the world suddenly started rethinking their manufacturing concepts.

Since then, the trend towards a decreased thickness of the porcelain layer, a limiting of this layer to the vestibular area and the production of monolithic restorations is clearly perceivable. Technicians have developed their own concepts of micro-layering, which allow for more patient-centred approaches. This is also due to the fact that the total wall thicknesses of the restorations may be decreased without compromising the aesthetics. The line-up of multi-layered zirconia currently available from Kuraray Noritake Dental Inc. (KATANA™ Zirconia UTML, STML, HTML Plus and KATANA™ Zirconia YML with additional translucency and strength gradation) enables users to make indication-related material choices for the production of restorations that are precisely aligned to the individual demands of each case.

THE REASONS TO CHOOSE KATANA™ QUALITY

But why choose KATANA™ Zirconia instead of any other multi-layered zirconia disc? According to experienced users of the KATANA™ Zirconia Multi-Layered series (hereinafter called KATANA™), there are many reasons to opt for KATANA™.

Naoki Hayashi, president of Ultimate Styles Dental Laboratory in Irvine, California, aesthetics is the most decisive argument to opt for the discs from Kuraray Noritake Dental Inc. He states:

"KATANA™ Zirconia discs offer trusted esthetics which gives me confidence in my clinical cases".

For **Jean Chiha**, owner at North Star Dental Laboratories and Milling Center in Santa Ana, California, it is the combination of optical and mechanical properties that makes the difference:

"KATANA™ Zirconia is the game changing material with well-balanced esthetics and strength!".

Naoto Yuasa, chief ceramist at Otani Dental Clinic in Tokyo, adds predictability as an important factor:

"KATANA™ sustains my passions for aesthetic restorations and those of a predictable future in the long run, whereas dependability is the key element."

For **Hiroki Goto**, the laboratory manager at Sheets and Paquette Dental Practice in Newport Beach, California reports:

"Without KATANA™ there is no pride. Haven't experienced it yet? You have to see how reliable it is!"

Finally, we have asked **Kazunobu Yamada**, a pioneer in making porcelain laminate veneers using complementary colour techniques and a first-hour user of KATANA™ Zirconia, what comes to his mind when thinking about KATANA™ Zirconia. According to the president of CUSP Dental Laboratory in Nagoya City, there is a clear link between the product name and its characteristics:

"Did you know that the word 'katana' also means 'protection against misfortune and evil'? KATANA™ Zirconia, the culmination of many years of research and development by Kuraray Noritake, has an unparalleled quality. KATANA™, for me, is truly 'Protection for all technicians'."

The origin of well-balanced properties

It seems that the KATANA™ Zirconia Multi-Layered line-up stands out due to set of valuable properties enabling a dental technician to produce beautiful, high-quality restorations every time. The secret of success lies in meticulous raw material selection and controlled processing from the powder to the pre-sintered blank carried out at the production facilities of Kuraray Noritake Dental Inc. in Japan. They provide for the high product quality that is responsible for the materials' outstanding behaviour supporting the best possible outcomes.

Photo courtesy of Dennis Debiase

INTERVIEW WITH ALEXANDER ARONIN

"GREAT ACCOMPLISHMENT SEEMS IMPERFECT, YET IT DOES NOT OUTLIVE ITS USEFULNESS."

LAO TZU, "TAO TE CHING" CHAPTER 45
5TH CENTURY BC (2500 YEARS AGO)
QUOTE FROM ALEK'S FAVOURITE BOOK.

Alek, many dental technicians decide to focus on CAD/CAM technology and automated processing of dental ceramics. Due to improvements on the material side, a handmade porcelain layer is no longer necessary in many clinical cases. In this context, the manual refinement process is reduced to a minimum. Why did you decide to take a completely different path and focus on fully manual dental craftsmanship?

The shift towards automated processing is not a matter of choice for dental technicians rather, it is a natural response to the evolution of technology. The high-end manual refinement process remains unchanged. The human element, from communication to hand crafting among skilled individuals and demanding clients, has been a constant so far throughout history. This traditional connection remains stable for centuries.
Digitalisation is not the revolution in the dental industry, and I do not see the benefit of it in our narrow specialization yet. In the area we are working, we do all steps of our case faster, incomparably more precise and more profitable. But we are keeping eye on machines and waiting for a suitable one.

Machines and automated processes widely serve mass production businesses focused on fast, affordable and uniform results in a highly competitive field.
Our goal and workflow are different - we provide individual work and personal attention to each of our partners and patients.

So, we do not compete with the production labs and do not interrupt each other, we coexist in parallel worlds as always. A small number of dentists and their patients will always demand personal attention and valued restorations and service of the highest quality.

Many dental technicians admire your work. Yet, you continue to strive for improvement. Why is this the case?

On one side, we are limited by static ceramic material used to mimic dynamic natural teeth that keep changing over a lifetime. On the other side, we are limited by our manual skills. I am still far away from my teachers and Japanese colleagues. My target is to improve the fabrication process. My goal is to achieve the simplicity and imperfectness like Aoshima-sensei.

We are enjoying the outcome, but prefer to focus on the improvement of the process, and move on to create a better one. This is what I am learning in Japan, and this is what I teach my students.

Talking about learning: what are the most important aspects a dental technician who wants to improve their skills should have in mind when looking for a good teacher?

Manual skills are very important, but not the only aspect that should be taken into account. Every individual should be motivated and guided and this is a teacher's job.

I love the traditional Japanese way of teaching and learning: the teachers are passionate, leading the way by evoking emotions and manual skills to bring the best out of every single student. My personal advice for dental technicians who want to become masters in the creation of lifelike high-end dental restorations is to select their teachers carefully and go to a private school or courses whenever they have the chance.

What are the most important tools a dental technician needs to use when trying to create high-end lifelike restorations?

I suggest to focus on four aspects:

1. Documentary dental photography - required for documentation and communication with the dental office and patients using constant (once set and never changed) parameters of the photo equipment.
2. Focus to the biomimetic additive dentistry. This is a minimum machine invasive field. Dental technicians and dentists should be able to develop a deep knowledge about clinical and lab-side procedures to be able communicate with each other.
3. Mastering morphology and function (shape carving), and anatomy (internal staining), which comes with value control and mimicking fine tooth details for best integration in the mouth.
4. Written communication (not phone calls) is very important, this is the way how to exchange the information between the patient, clinic and lab by strict protocols.

Alek lecturing at the IDS 2023 in Cologne. Photo courtesy of Dennis Debias

I teach these complex skills in my morphology school and in many of my trainings worldwide. Focusing on the four aspects, a dental technician has a great chance of becoming a good specialist in a relatively short period of time in a narrow field.

Is material selection important for achieving great results?

I've been using Noritake ceramic for most of my life, and the reason is simple: Noritake created their EX-3 porcelain over 40 years ago, and it was so well-made that it has not needed any changes since.

This shows their consistently high quality and creates unbroken succession in the valuable tradition of passing on techniques and knowledge.

Today, among different generations of dental technicians, we can use and share the same methods, vocabulary and abbreviations, powders, and temperature charts developed by our skilled teachers 30 to 40 years ago. This unique feature sets Noritake and Creation porcelains apart from all other brands and systems in the world.

The other Noritake porcelain I use quite frequently is CERABIEN™ ZR, which is also well tried-and-tested and has even some more advantages than EX3.

Is there any final advice you would like to give?

To become a good professional, I suggest developing in four parallel directions:

1. Practicing on phantoms - fabricating cases and ceramic samples. It helps to experiment and practice with varied materials and techniques.
2. Implementing the achieved techniques in clinical cases.
3. Working with case presentation PowerPoint or Keynote: documenting the working steps in pictures and videos from beginning to end.
4. Mastering the communication using e-mails. Constantly calibrate and adjust the information exchange process between the clinic and lab. Acquire deeper knowledge about each other's work.

Good luck!

ALEKARONIN

KURARAY NORITAKE DENTAL APP

WHAT IS THE OFFICIAL KURARAY NORITAKE DENTAL APP?

The Kuraray Noritake Dental app is designed to support dentists, lab technicians and ceramists world-wide by providing a range of tools and resources related to our dental materials and procedures.

WHAT ARE ITS CHARACTERISTICS?

EASY TO GET PRODUCT INFORMATION!

Various product brochures are posted. Would you like to check the usage and product contents? Then install the app and get the information you want to know immediately.

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New magazine articles and videos are also posted. Various visual approaches allow you to see product features and operating procedures.

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SUPPORT FOR YOUR DAILY CLINICAL PRACTICE!

"KATANA™ Color Simulator" that allows you to perform color simulation of KATANA™ Zirconia on the screen for the conditions of the abutment tooth and the target color of the prosthesis. In addition, "Cementation Guide" will help you with your procedures using our cements through step by step instructions in which you will be able to select the type of abutment and prosthetic restoration.

Since you can easily view it from your smartphone or tablet, you can access it **anytime** and **anywhere**. There is no doubt that it will also be very useful as a staff training tool.

YOU'VE GOT LOTS OF BENEFITS! WHY DON'T YOU CHECK IT OUT?!

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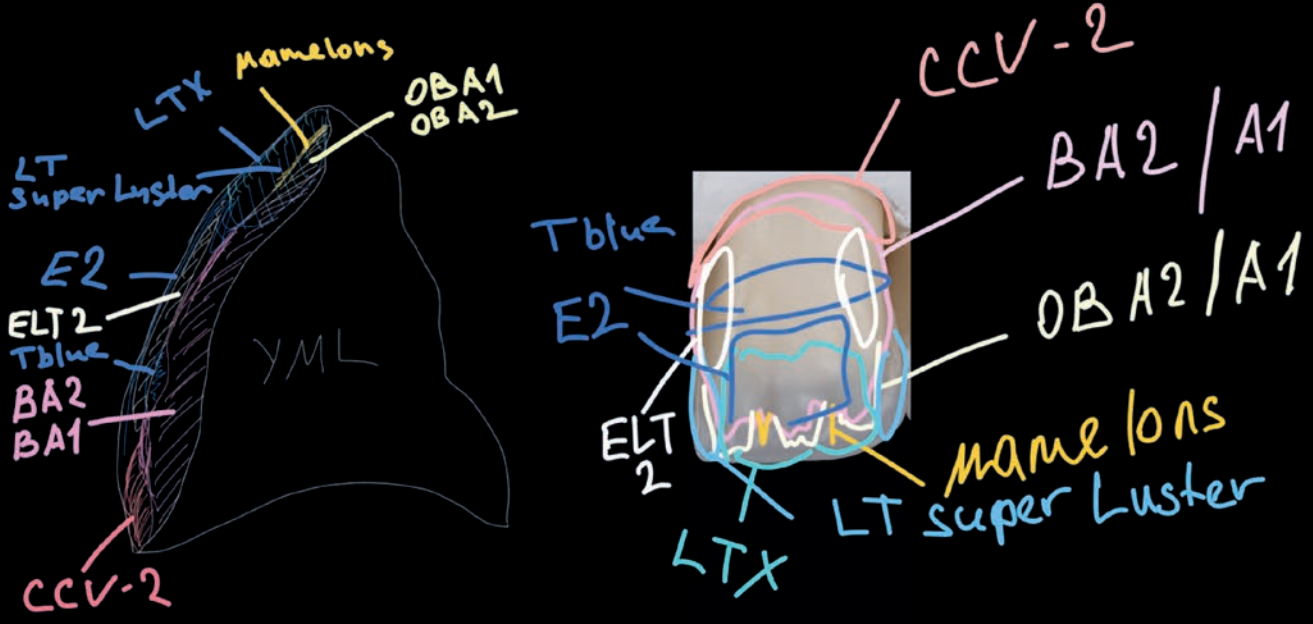

A NEW SMILE WITH ONLY 4 ZIRCONIA CROWNS

WITH KATANA™ Zirconia YML AND CERABIEN™ ZR PORCELAIN

CASE BY KANSTANTSIN VYSHAMIRSKI

Initial situation

A male patient (47 years of age) presented to his dentist with severe damage to his teeth. His main request was to increase aesthetics, to achieve a more pleasing envisaged aesthetic area. A side request was to achieve a 'whitening but natural look'. This was achieved by using a lighter colour palette of zirconia and porcelain materials.

The final result was achieved through the creation of a wax-up, followed by a mock-up, provisional restoration and finally adhesive bonding of the zirconia crowns.

Fig. 1. Initial situation. Male patient (47 years of age).

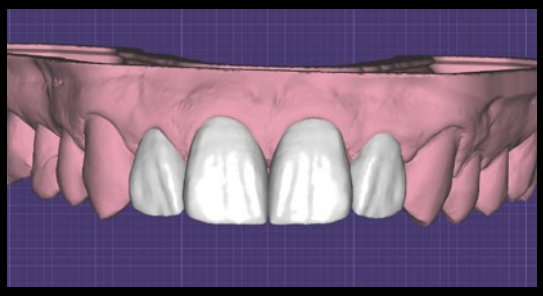

Fig. 2. Planning the new smile according to patient's aesthetic and functional parameters.

Fig. 3. Mock-up in place to check the new look in the patient's mouth.

Fig. 4. KATANA™ Zirconia YML shade A1 crowns with labial cutback after milling.

Fig. 5. Crowns after sintering on the plaster model.

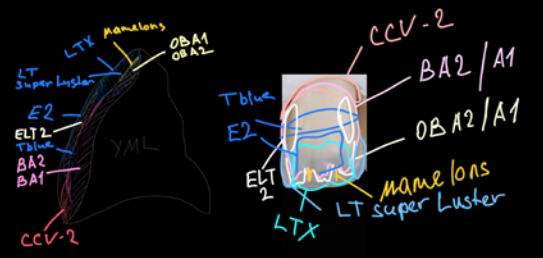

Fig. 6. Noritake CERABIEN™ ZR porcelain layering map.

Fig. 7. Finishing the labial surface using both polishing and selfglaze. On the palatal side of the crowns only CERABIEN™ FC Paste Stain stains and glaze were used for finishing. To aid in optimisation of the soft tissue condition the palato-cervical and near proximal areas were polished.

Fig. 8. Finished crowns on the plaster model.

Fig. 9. Try-in using PANAVIA™ V5 Try-in Paste White, to confirm the proper appearance. For the final adhesive cementation PANAVIA™ V5 Paste White has been used.

FINAL SITUATION

Fig. 10. Situation after seven months. The result is aesthetically pleasing and the gingival condition excellent.

Fig. 11. Recall after 1.5 years.

Kanstantsin Vyshamirski

Kanstantsin started his dental technician career in 2014. His speciality is aesthetic prosthetic porcelain works. Kanstantsin is an experienced user of KATANA™ Zirconia and Noritake porcelains. He owns his lab in Riga, Latvia.

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FROM PANAVIA™ FAMILY

EXCELLENT BOND STRENGTH

Original MDP monomer

OUTSTANDING AESTHETICS

5 shades and matching Try-in Pastes

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Always the same procedure steps

PANAVIA™ V5

Our strongest bonding cement ever developed and with five shades, our most aesthetic one too. This makes a totally new kind of dentistry possible, where you can be confident during cementation. Prime the tooth. Roughen and prime the prosthetic. Apply the cement and cure. That's it. Predictable way to durably cement your crown, cantilever bridge and core build-up.

And if in a lab? Then you can be sure it's the way to cement your implant abutments too. See, with just one prime procedure you cover all common cement indications. And your patients? They will surely be impressed by the beautiful results of your prosthetic treatment.

SCAN ME

WHITE AND PINK AESTHETICS:
ACHIEVING MAXIMUM QUALITY IN A MINIMUM AMOUNT OF TIME

INTERVIEW WITH ANDREAS CHATZIMPATZAKIS

Fewer bakes, fewer ceramic powders - there is clearly a trend toward simplification in the production of zirconia-based prosthetic work. This is also true for implant-based restorations, which often involve gum parts. DT Andreas Chatzimpatzakis, international trainer for Kuraray Noritake Dental Inc., and the owner of ACH Dental Laboratory in Athens, Greece, shares his approach to high aesthetics in implant prosthodontics in the following conversation.

You are a user of the CERABIEN™ ZR portfolio from the outset. When did you test the products for the first time and why?

Well, it was many years ago when I finished my very first zirconia-based restoration. The reason to test CERABIEN™ ZR was that when I asked the dental technician who had milled the framework which porcelain system to use. He suggested to use CERABIEN™ ZR, which I did. I was immediately impressed by the system and by the outcome I was able to achieve on the first attempt.

Did you ever test any other porcelain systems for ceramic layering?

Yes. Before I becoming an international trainer for Kuraray Noritake Dental Inc., I had the opportunity to test many other porcelain systems for layering on zirconia. Based on this experience, I can say that CERABIEN™ ZR is unique and the best system I have ever used. The reason is that its translucency and chroma are extremely close to natural teeth. In addition, due to a controlled firing shrinkage, a One-Bake Technique may be employed even in long-span restorations.

Your hands-on demonstration at the Kuraray Noritake Dental booth during the IDS 2023 in Cologne focused on White and Pink Aesthetics achieved with CERABIEN™ ZR. Is there a specific concept you use?

Nowadays, everyone producing dental restorations – no matter whether based on natural teeth or on implants – is confronted with increasing aesthetic demands of patients and dental practitioners. The high demands are developed because life-like restorations and cosmetic dental treatment outcomes are presented everywhere in the web and on social media. The showcased quality of outcomes is simply expected, even if the financial budget is limited. To be able to fulfil these demands in the field of implant-based prosthodontics, I have developed an approach that allows me to achieve high aesthetics with little effort. My concept is based on not using too many ceramic powders. For extra chroma and special characterization, I rely on the power of the internal live stain technique, first introduced by Hitoshi Aoshima-sensei.

Please summarize the most important details of your presentation.

The first important detail is the design and characterization of the framework. Before sintering, I apply Esthetic Colorant for KATANA™ Zirconia. After the sintering process, shade base stain and internal stains are mixed and applied. In this way, I create a nice canvas that helps me to achieve a life-like result with only a few selected ceramic powders. In most cases, three to five powders are enough to produce a great result. Among the powders used most frequently are Opacious Body, Body, LTX,

Fig. 1: Complex implant-based restoration: framework design.

Fig. 2: Esthetic Colorant …

Fig. 3: … applied prior to the final sintering procedure.

Fig. 4: Appearance after sintering.

Fig. 5: Final outcome.

Fig. 6: Clinical example of achieving high aesthetics in a minimum of time: Before …

Fig. 7: … and after crown placement.

Fig. 8: High aesthetics …

Fig. 9: … achieved in a minimum of time.

Mamelon and CCV. After the first bake and a little grinding, I make use of internal stains again. They offer support in the controlling of the chroma and the integration of special characteristics. When this step is completed, the final build-up is done with one or two ceramic powders, mostly LT1 and Enamel or LT0. Pink aesthetics are usually created with Tissue 1, 3 and 5. For the free gingiva, LT Coral is my go-to solution. The major goal is always to obtain maximum quality in a minimum of time. To achieve this, a good knowledge of the materials and of course practicing – on both, porcelain build-up and morphology – are strictly required.

Are there any concrete tips and tricks you would like to share?

For the characterization of the framework, I mix the internal stains with shade base stain powders; mostly with SS Fluoro. For the first bake, especially when the restoration is large and the amount of ceramic to be applied huge, I reduce the heating rate up to 38 degrees per minute. I also increase the drying process up to 17 or even 20 minutes depending to the restoration. Experience shows that these measures optimize the aesthetic outcomes.

You often mention that it is extraordinarily important to understand the morphology of natural teeth to be able to produce beautiful restorations. Why is this the case?

A successful prosthetic restoration needs to offer proper function and aesthetics. Function means a precise fit, perfect contact points and occlusion, a proper emergence profile and interproximal embrasures for self-cleaning etc. All this is described by the term morphology. Aesthetics, on the other hand, are guided by shape and colour. The effort required to establish a proper morphology is much higher (about 70 percent of the total work) than the effort involved in obtaining the right translucency, opalescence and chroma.

What instruments do you use to imitate the morphology of natural teeth and how do you do it?

I usually make use of the Optimum™ Spring Ceramic Brush Size 8 (MPF Brush Co.), stones and diamond burs for detailed grinding and carving after the final bake. I studied morphology at the Osaka Ceramic Training Centre in Japan with Shigeo Kataoka-sensei. According to him, a key factor in creating a perfect macro and micro morphology lies in the shadows. To be able to take into account the interference of light and shadow during grinding, a light source is placed on one side of the restoration.

How many bakes do you need to produce highly aesthetic restorations?

It depends on the case, although in many situations, I nowadays opt for some kind of micro-layering. Lately, I have used micro-layering a lot with internal stain directly on the zirconia framework. In other cases, I do a quick first bake, then the internal staining, a final bake and glazing. For small or single-unit restorations in the posterior region, a One-Bake Technique is often sufficient. Even a Zero-Bake approach using Esthetic Colorant on a monolithic zirconia restoration may be appropriate here, and it is very convenient. If there is a restoration with high aesthetic demands – these are typically single anterior restorations – the technique I select depends on the shade. In some cases, using only the internal stain technique is enough to reach a high aesthetic level, while in other cases, additional steps need to be taken. To my mind, there is no single technique that fits all cases. As mentioned before, I try to achieve high aesthetics in the minimum of time.

Did your approach change due to the availability of high-translucency zirconia materials with colour (and flexural strength) gradation?

Well, yes! My overall approach changed more to micro-layering. Several years ago, we needed to consider how to mask the framework and how to achieve translucency in areas with limited space. The problem was solved for single-unit and small anterior bridge restorations with the availability of KATANA™ Zirconia UTML and STML. With the introduction of KATANA™ Zirconia YML, a high-translucency material became available for long-span or implant-based restorations as well. We have strength and translucency all in one disc. In most of my cases, the framework material replaces the dentin with regard to morphology and shade. Hence, I need to focus on adding the enamel by applying the transparent and translucent powders. The powders of the internal stain technique are used to characterize the framework, and with a micro-layer of porcelain, the goal of creating an aesthetic restoration in the minimum of time is achieved. This is exactly why I am sure that micro-layering is the future.

What drives you to share your knowledge with others?

My passion! I love my work! And I love to see technicians become better and better. Dental technology is an exciting journey, a journey that begins when the first impression arrives in the dental laboratory, and it ends when the final restoration is cemented into the patient's mouth. And this journey is so exciting because we change lives. We change people's personalities, we give them back their smile, we give them back their self-respect. Consider that every day, every single moment working on our bench trying to imitate nature… there is nothing more exciting than that!!!

My approach as an instructor is to lead dental technicians to master the art of observing natural teeth. This is the way every individual will understand morphology and shade. You need no special talent to be a very good dental technician. You need to observe! Your eyes see, your mind understands, and your hands will follow.

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