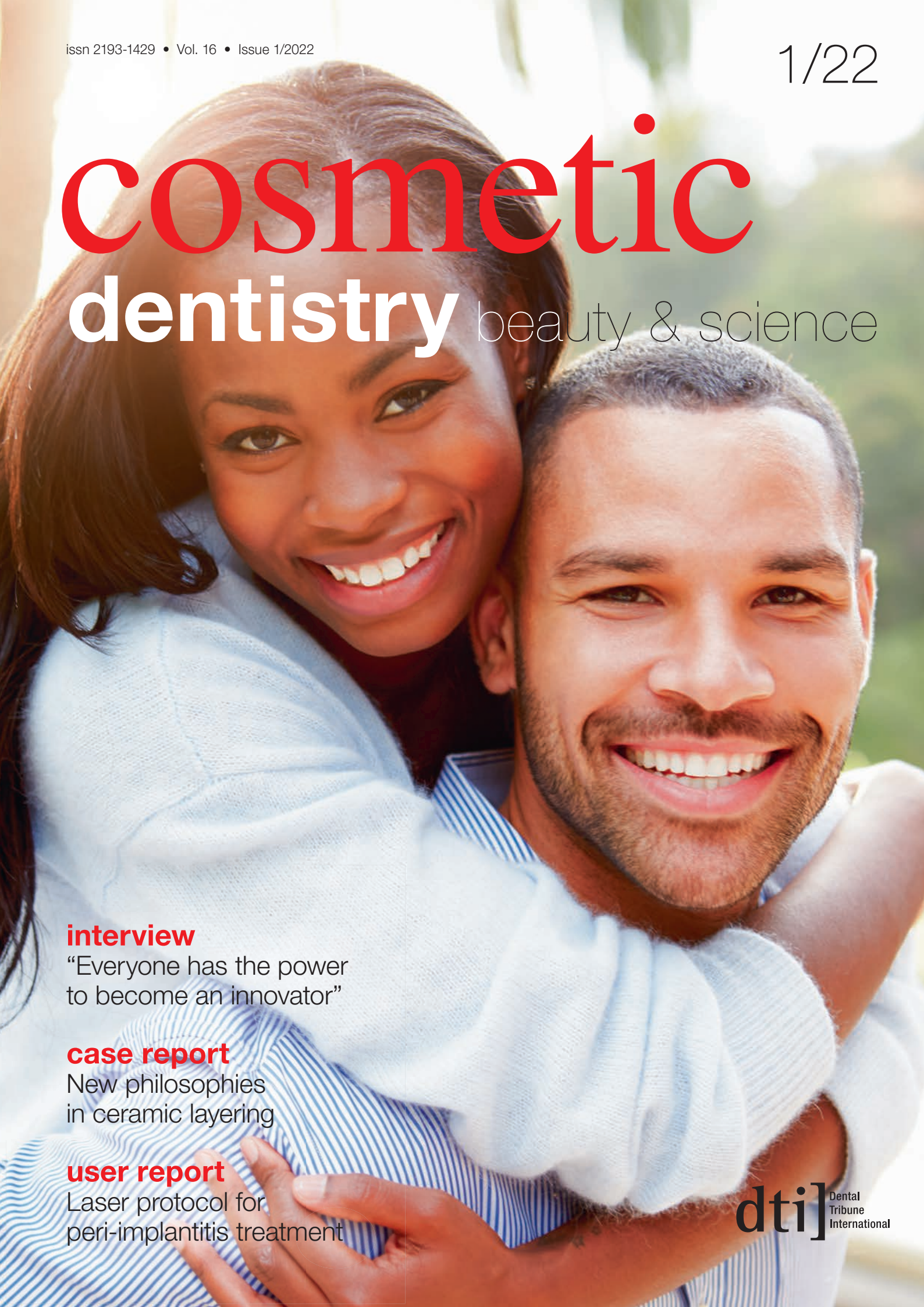
issn 2193-1429 • Vol. 16 • Issue 1/2022

1/22

cosmetic dentistry beauty & science



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Dr Sushil Koirala

Editor-in-Chief

MiCD knowledge philanthropy

cosmetic **dentistry** has become one of the most popular clinical cosmetic dentistry magazines in the world. This success has in large part been due to the high standard of clinical articles submitted by the authors, the article selection approach of the editorial team and the print quality. Because of this, we were able to offer free accessibility to the digital version of the magazine on Dental Tribune International's (DTI's) official websites and those of partner academies, which was indeed a major step forward. I appreciate this knowledge-sharing initiative of DTI, which has facilitated my personal mission of promoting the knowledge philanthropy concept in the field of dentistry.

I vividly recall that, in the editorial I wrote for cosmetic **dentistry** *1/2009*, I discussed the scope of the minimally invasive concept in cosmetic dentistry, and in issue *4/2009*, I wrote a comprehensive article proposing the minimally invasive cosmetic dentistry (MiCD) concept and its treatment protocol. The MiCD concept, as we look back at it 13 years since its inception, has been widely recognised and very well received by global clinicians.

It is my pleasure to report that, thanks to the overwhelming acceptance of the MiCD concept and treatment protocol in aesthetic dentistry, we have expanded the clinical horizons of MiCD from cosmetic to comprehensive dentistry. The encouraging responses, suggestions and requests from clinicians, researchers and academics around the world have led us to take MiCD Global Academy management from a privately governed and exclusive sponsorship approach to a nonprofit and open sponsorship approach. From 1 June, this new philanthropic approach began under the philanthropic dental education wing of the Dental Community for Humanity division of the Punyaarjan Foundation in Kathmandu in Nepal to promote the MiCD mission as an independent and non-commercial initiative in dental education.

With this, the MiCD Global Academy has morphed into the MiCD Knowledge Philanthropy Academy with the support of many knowledge philanthropists and open-minded dental companies. This has been done with the objective of serving the global dental profession and humanity through the science and technology of MiCD.

To make MiCD knowledge and skills easy to understand and apply in daily practice, I have broadly divided the MiCD care and education system into four domains, namely MiCD lifestyle dentistry, MiCD functional healthy dentistry, MiCD cosmetic dentistry and MiCD practice management. MiCD care and education in all these domains are based on the premise of the MiCD concept that I proposed in 2009. Alongside the introduction of these domains, related free MiCD educational materials will be published in the upcoming MiCD clinical journals and DTI publications according to the need of and demand by readers.

I hope that the global dental fraternity will greatly help us foster our initiative of MiCD knowledge philanthropy, and I urge all our readers to take the opportunity to be part of the MiCD global mission.

I express my gratitude to our valued readers, esteemed authors, advertisers and everyone who has directly and indirectly supported cosmetic **dentistry** and thus helped bring the magazine to where it is now. I hope you will enjoy this issue of cosmetic **dentistry**, and I invite you to send your valuable feedback and ideas.
Sincerely yours,

Dr Sushil Koirala
Editor-in-Chief


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“I hope that sustainable dentistry will soon reach critical mass and become the norm”

An interview with Dr Davinder Raju

Dr Davinder Raju

By Iveta Ramonaite, Dental Tribune International

Dr Davinder Raju is the lead dentist at Dove Holistic Dental Centre in Bognor Regis in the UK and the founder of Green Dentistry, an online platform that helps dental practices become more environmentally conscious and reduce their carbon footprint. In this interview with Dental Tribune International, Dr Raju, an ardent advocate of sustainability, explains why he thinks apathy and the fear of litigation are the greatest enemies of sustainable dentistry and how dental professionals often have false beliefs about sustainability. He also discusses why having an environmentally aware team with a can-do attitude is essential in order to promote sustainable practice and describes why the dental industry should be transparent about the environmental impact of its products.

Dr Raju, what does sustainability mean to you personally, and how would you define sustainable dentistry?
I'm continually amazed at the abundance of life that our planet has to offer, and it is something that future generations should have the opportunity to enjoy. To me, sustainability is about being a good custodian of the environment and ensuring the well-being of future generations. It's about making decisions that reduce environmental impact. I'm deeply concerned about the fact that underprivileged children will suffer disproportionately more in light of the consequences of unchecked climate change.

As for sustainable dentistry, I would define it by combining Gro Harlem Brundtland's famous definition of sustainability with minimally invasive dentistry. Sustainable dentistry involves delivering optimal oral and dental healthcare, with a focus on prevention, early diagnosis and management, using minimally invasive operative procedures and having the best long-term interests of patients at heart, while at the same time mitigating negative impacts on the planet so that we do not undermine prospects for future generations.

> "There has to be clear leadership and a desire to embrace sustainability in order to promote sustainable dentistry."

Using a minimal intervention approach to dentistry means that patients are less likely to enter the restorative downward spiral, thus reducing the need to provide resources such as dental restorative materials.

You believe that great leaders should know not only why they are running a practice but also how they are running it. Could you elaborate on that?
We know that greenhouse gases emitted by human activities cause climate change and that the effects of climate change, some of which are already apparent, pose a global health threat.

Now, "to do no harm" is one of the pillars of medical ethics, yet globally, the health sector emits more carbon dioxide than Japan, which is currently ranked as the fifth highest emitter of all countries. Given its mission to protect and promote health, the health sector, including dentistry, has a responsibility to reduce its own climate footprint. This can only be accomplished by examining how we are providing services. Only by scrutinising how we operate can we consider the possibility of delivering the same service, but by employing an approach that has a lower environmental impact.

Climate change will become an increasing concern for consumers, and the dental profession must take action to reduce the harm that healthcare is causing.

To follow up on the previous question, what motivated you to found Green Dentistry, and how do you promote sustainable development in your business?
I first need to explain why I set up an eco-friendly dental practice. The catalyst came about when I was studying for my master's degree in advanced minimum intervention dentistry. I was struck by the ecological plaque hypothesis. Inside a healthy mouth, there is a stable and healthy community of cells—microbial homeostasis—where a mutually beneficial equilibrium exists between

the microflora and the host. If this balance is upset, disease ensues. Consequently, I started thinking about the effects of my business on our host, namely the environment, and how I could mitigate that impact.

When I wanted to set up an eco-friendly dental practice, information about sustainable dentistry wasn't readily available. Since there seemed to be a lack of practical advice, I had to piece information together from other industries. Green Dentistry came about when I was approached by other dentists who wanted to make their practices greener but didn't quite know where to start.

There has to be clear leadership and a desire to embrace sustainability in order to promote sustainable dentistry, and having an environmentally aware team with a can-do attitude is essential. As a practice owner, I'm busy running the practice, and I don't have the time to manage day-to-day activities. Good ideas and strategies aren't worth anything if you can't implement them, so I delegate the role of maintaining the changes to a sustainability champion. However, we need the entire team to be on the same page for both coherence and creativity. The team needs to be willing to suggest ideas to the sustainability champion and to ensure that they are discussed at practice meetings.

> "We've taken many steps in the right direction, but we never assume that we've done enough. I want the team to be forward-thinking and future-oriented [...]"

Running a sustainable practice is about creating a culture that consistently seeks new opportunities to improve efficiency and environmental performance. The right team is essential, and its members need to unite and collectively participate. We've taken many steps in the right direction, but we never assume that we've done enough. I want the team to be forward-thinking and future-oriented, almost as if the team members are carrying out mini eco-audits as they're walking through the practice, carrying out their regular procedures while thinking to themselves: "Is there a better way of doing this? Is there another product we could be using?"

Sustainability is gaining increasing awareness in dental practices worldwide. How would you explain this trend?

Programmes like David Attenborough's television series *The Blue Planet* and professional magazines such as the *British Dental Journal* have all helped raise awareness of sustainability. Still, there is possibly a disconnect between what we do at home and in our working environments. During the COVID-19 pandemic, many dental professionals were alarmed by the large amounts of extra personal protective equipment that they had to use. This may have produced a cognitive tipping point and made dental professionals realise how much the dental sector negatively impacts the environment.

I believe that sustainable dentistry is currently being introduced to the dental curriculum at King's College London and hopefully at other dental teaching hospitals. I hope that sustainable dentistry will soon reach critical mass and become the norm.

Why is it crucial that the dental industry is transparent about its supply chains and environmental policies?

The lion's share of carbon dioxide emissions produced by the provision of healthcare are generated upstream and are attributable to the supply chain through the extraction of raw materials and the production, transport and distribution of goods and services. If the dental industry is transparent about the environmental impact of its products, we, as end users of dental products and materials, can make greener procurement choices. In addition, industry-wide environmental policies that promote responsibility and accountability will help those working in the dental profession to determine with which companies they wish to align themselves and do business.

What would you say is the greatest enemy of sustainable dentistry, and what are some of the barriers to sustainability in dentistry?

The greatest enemy of sustainable dentistry is apathy. It is the feeling that, since dentistry's overall impact is relatively small compared with, for example, coal-fired power stations, there's no point in making the necessary changes towards a more environmentally sustainable future within the dental environment. However, we can't be passive bystanders. We can't stand back and be spectators knowing that conditions that humans have created, and are continuing to create, are a threat to humanity and other life forms.

We are facing a climate crisis, ever-shrinking biodiversity and acidification of the oceans. We can vote for policymakers who prioritise the environment and make a move towards delivering sustainable dentistry now. Regulatory change will come eventually, but we shouldn't wait for the government to take action. It's immensely satisfying to do the right thing.

The fear of litigation is also a barrier to embracing sustainability. In the UK, *Health Technical Memorandum 01-05: Decontamination in primary care dental practices* has resulted in a significant increase in the use of single-use plastics and increased costs for dental practices. Although aware of the importance of infection prevention, we seem to have tipped too far on the side of caution. If used appropriately and recycled when possible, plastic is a valuable material. However, single-use plastics are now ubiquitous in the dental environment.

There is also a common perception that the changes necessary to achieve a more sustainable approach are expensive to implement. Yes, you can spend a great deal of money on capital expenditure by purchasing solar panels, ground source technology or heat pumps, but this isn't the only way to achieve a more sustainable approach to delivering dentistry. For example, if a practice wants to help reduce carbon dioxide emissions, it can simply switch to a renewable energy provider. As demand grows, renewable energy will increasingly be sourced for the grid, thus reducing the supply generated from fossil fuels.

It's picking the low-hanging fruit that hopefully will spark a change in behaviour towards sustainable practice.

What measures do you take outside of work to minimise your impact on the planet?

We obtain our energy from a renewable energy provider at home, don't eat meat (for ethical and environmental reasons) and buy organically grown food. Last year, we started growing our own vegetables fed with home-made fertiliser made from comfrey and nettles. We also compost.

We have a wild flower garden at the front of our house, which has never been mowed in order to help increase biodiversity. It looks a mess for a few months of the year, but it is delightful when the flowers appear. We also recycle, of course, but more importantly, we're not big consumers. If we buy goods, we try to buy sustainably sourced goods whenever possible.

Editorial note: More information can be found online at www.greendentistry.co.uk.

Fig. 1: Dr Sumita Mitra has dedicated more than 30 years to the development of dental materials. *(All images: © European Patent Office)*

"Everyone has the power to become an innovator"

An interview with Dr Sumita Mitra

By Franziska Beier, Dental Tribune International

Dental Tribune International (DTI) interviewed Dr Sumita Mitra, chemist and awarded dental materials inventor. During her career at 3M, she developed a unique nanomaterial-based dental filler, for which she received the European Inventor Award 2021. This material and numerous other inventions of hers in the field of dental materials have been patented. DTI spoke with Mitra about how a bunch of grapes inspired her research efforts, about the greatest advantages of her developed material and about how she gives back to the next generation of inventors.

Dr Mitra, thank you for agreeing to this interview. Could you tell us something about your background?
I grew up in India and had my early education there. I did my BSc at Presidency College in Kolkata with chemistry honours. After my MSc in chemistry in India, I came to the US and obtained a doctorate in organic/polymer chemistry in 1977 from the University of Michigan in Ann Arbor. After a year of postdoctoral work at Case Western Reserve University in Cleveland in Ohio I joined the 3M Corporate Research Laboratories in 1978 and later moved to the 3M Dental Products Division (now 3M Oral Care) in 1983. There I held positions of increasing responsibility and in 1998 was appointed corporate scientist, the highest technical position at 3M. I led the new materials/products research and development efforts until my retirement in 2010. From 1999 to 2010, I also served as the industrial director of the Minnesota Dental Research Center for Biomaterials and Biomechanics at the School of Dentistry at the University of Minnesota in Minneapolis.

Currently I am a partner at Mitra Chemical Consulting, an independent consulting firm, which I co-founded.

Why did you decide to go into chemistry and how did you become concerned with dental materials?
From a very early age I was fascinated by different materials. I often wondered what makes one material different from another—things like why paper is different from wood, or why fabric is different from our skin. I learnt that the answer is in the molecules—it is chemistry that is the central science that defines materials. I was so awestruck by the subject that I made up my mind to study chemistry in depth. I would often visit my father in his laboratory and peer over his shoulders as he did his chemistry experiments. After I joined the 3M company, I got an opportunity to join its Dental Products Laboratory to develop new polymer matrices for dental composites. I jumped at that prospect and spent most of my career there, developing many new materials technologies, including the development of nanotechnology for use in dentistry.

You have developed a nanocomposite restorative material (Filtek Supreme, 3M), that has already been used for more than 1 billion tooth restorations. How did you come up with the idea of using nanotechnology?

> "From a very early age I was fascinated by different materials. I often wondered what makes one material different from another."

Until the late 1990s dentists wanting to perform natural-looking tooth repairs relied on a combination of two separate materials. Microfills were aesthetically pleasing but too weak to be used for stress-bearing regions of the incisal edges and for filling teeth in the posterior region of the mouth. Less attractive hybrid and microhybrid composites were stronger, but lost their shine and became rough from brushing and chewing. This was both inconvenient and expensive for dentists and their patients. So, we wanted to create one material that would not only be strong and durable but also have the long-lasting lustrous beauty of natural teeth.

Fig. 2: Dr Mitra at the 3M Innovation Center in Minneapolis in Minnesota in the US.

Fig. 3: Together with scientists at 3M, Dr Mitra invented the nano-based filling material Filtek Supreme.

I realised that the key problem was that the existing filler technology used to reinforce dental composites had limitations. Around that time, nanotechnology was an emerging science. I hypothesised that developing nanoparticle technology for use as dental fillers could allay most of the problems and afford us a universal filling material. This is because nanoparticles are much smaller in size than the wavelength of light and thus could provide unique aesthetic properties. In addition, nanoparticles had the potential of providing mechanically strong materials. With this idea, and with the help of a team of 3M scientists, I set about the task of developing suitable nanofillers and incorporating them into a resin matrix to generate nanocomposites with superior characteristics.

Our initial approach was to make tiny nanoparticles of several sizes, but this approach was disappointing since it did not provide all the desirable characteristics, especially the required rheology or handling properties needed by dentists. I realised that this was because we needed nanoparticles of a wide size distribution to get packing efficiency in the composite. It sounds simple but was not easy to achieve with the initial nanoparticles.

The decisive idea for the material was inspired by a particular fruit. Could you tell us more about this?
The breakthrough moment came as I was looking at a cluster of grapes in a bowl. If one observes a bunch of grapes, there are grapes of different sizes, some small and some large, with the small ones fitting in between the gaps created by the large ones, leading to optimum use of space. Also, the sizes of the bunches can vary greatly—there can be clusters of five, 20 or 100 grapes, and so on. If one or two individual grapes are plucked out, the overall cluster doesn't change that much. My theory was that we could first assemble the nanoparticles into nanoclusters of wide size distribution and then combine them with individual nanomeric particles to fill any voids to provide a synergistic mix that could then be incorporated in a dental resin to create the composite. This is what I set out to do, with the help of the excellent team at 3M.

The end result of all that hard work is the universal filling material 3M Filtek Supreme. Since the original material was introduced in 2002, several updates have been made and a family of Filtek products has been introduced for the benefit of dentists and their patients.

Would you please explain how the material works exactly and what some of its greatest advantages for dentists and their patients are?
The 3M Filtek Supreme product is an uncured composite paste, which comes in a number of shades that make it possible to exactly match the patients' dentition. After using a dental adhesive, the dentist places the composite and shapes it according to the required anatomy, finally curing it in place by a short exposure to blue light. The greatest advantage is that the material is very versatile

and can be used in all areas of the mouth—anterior, posterior, and on incisal or molar surfaces. It is highly aesthetic and has the shine and opalescence of a natural tooth. It is extremely durable and withstands the forces of chewing and brushing without losing its shine for a long time. Dentists all over the world have expressed their enthusiasm and shared examples of their work, which is very gratifying.

Your material has been patented. Aside from this product, do you hold any other patents for dental applications?
I hold 100 US patents, 58 European patents and their corresponding equivalents in other countries. The majority of my patents are in the area of dental materials.

You have been awarded and honoured many times, including being inducted into the US National Inventors Hall of Fame in 2018. Last year, you won the European Inventor Award 2021—in the category Non-European Patent Office countries. Congratulations! How meaningful are these awards to you?
I feel greatly honoured to be recognised by organisations like the National Inventors Hall of Fame, the American Chemical Society and many others, including most recently the European Patent Office for this invention. It is quite humbling to be included in the same league as so many well-known inventors whose work has greatly benefited society. This type of recognition validates the importance of the scientific contributions of scientists and increases public awareness of the pivotal role that science and technology play for the advancement of society. Another important aspect is that the award creates role models for aspiring scientists who pursue careers in science, technology, engineering and mathematics (STEM)-related fields. Furthermore, awards like these give a voice to science and help in influencing greater funding for scientific research and policymaking.

In your opinion, what are the essential characteristics that a person needs in order to start an innovation?
Basically, it is a combination of curiosity, exploration and imagination. Of course, you need a scientific training, but above all, you have to try new ways of doing things—a way that is more convenient and or easier. The other thing is to have passion coupled with persistence. The first attempts may not be successful, but failures should never discourage us. They only show us that there is another pathway toward achieving a goal.


4

How do you inspire young people and what would you tell the next generation of potential innovators?
After my retirement, I have spent many hours volunteering and teaching at a number of local organisations, encouraging STEM education at all levels, primary school to postgraduate. It is a way for me to give back to society for all the opportunities I have had.

Everyone has the power to become an innovator. The important thing is to understand that a solid foundation in STEM-related fields gives young people the toolset to unleash their creativity and design better approaches to improving the well-being of society. I always tell young people, “Believe in yourself, seek help when needed, and never give up.”

Fig. 4: Dr Mitra loves art and enjoys painting with watercolours in her free time.

Direct restoration procedures simplified

Transforming dentistry with groundbreaking technologies

By Kuraray Noritake Dental

Some companies mainly make use of basic technologies developed by others to improve their products and introduce new ones, while other companies conduct fundamental research and technology development in-house. Is this difference relevant for someone who uses the resulting products in the dental practice or laboratory on a daily basis? It is. Companies that develop everything from scratch usually have a deeper understanding of the products and their production procedures, making it easier for them to modify specific features, solve existing problems and respond to market needs. This article describes the impact of several basic technologies developed by Kuraray Noritake Dental on the workflow for creating direct composite restorations.

Direct restorations—from complex to simple

Adhesive restorative dentistry using high-performance dental adhesives and resin composites is currently one of the most popular approaches to treating teeth with carious lesions. Nowadays, a single-bottle universal adhesive and one or two shades and opacities of universal composite are usually enough to create beautiful and durable outcomes, provided that the right materials are selected.

This, however, has not always been the case. For a long time, the techniques used to create direct restorations were quite complex. Adhesives were technique-sensitive multi-bottle and multistep systems with long application times. Composite filling materials only produced lifelike outcomes when many different shades and opacities were combined in the right way. Even if the complex procedures were carried out correctly, the risk of microleakage, discoloration and eventually secondary caries was comparatively high. Kuraray Noritake Dental focused on solving these issues quite early on, starting with the utilisation of the original MDP monomer developed in 1981.

> "The original MDP monomer creates a strong chemical bond to enamel, dentine, metal alloy and zirconia."

Optimising bonding performance

The original MDP monomer addressed the issue of limited long-term bonding performance of adhesive systems. MDP's hydrophilic (phosphate) group forms a particularly strong and long-lasting chemical bond with

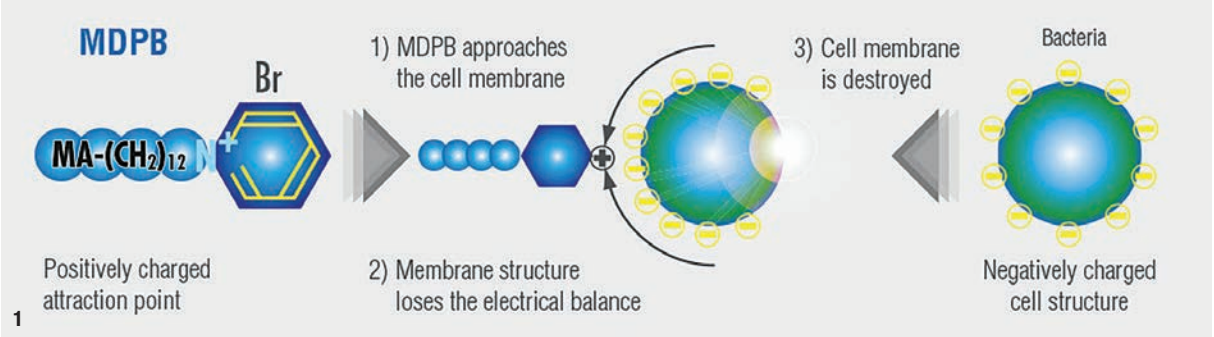


Fig. 1: The bactericidal mechanism of MDPB is presumed to be similar to that of the well-known antibacterial agent cetylpyridinium chloride, which is in many toothpastes and mouthrinses.

calcium found in hydroxyapatite. The MDP–Ca salt formed provides the basis for a stable, strong and durable hybrid layer. In combination with the resin in the bonding agent, a tight seal of the cavity after light-polymerisation is the result. To date, MDP is still an essential component of any adhesive product from Kuraray Noritake Dental, and it is the key component that made CLEARFIL SE BOND the gold standard self-etching adhesive system.

However, convinced that dental adhesives should provide for more than a strong and long-lasting bond, Kuraray Noritake Dental started to focus on solving another issue: the risk of demineralisation and cavitation caused by bacteria remaining in the cavity. Based on its experience in developing other adhesive monomers, Kuraray Noritake Dental invented the MDPB monomer, which has an antibacterial cavity-cleansing effect. Different from antibacterial agents that might impair the bond strength of a subsequently applied adhesive, the MDPB monomer kills remaining bacteria without affecting the bonding performance. It is contained in the primer of the two-bottle self-etching adhesive CLEARFIL SE Protect and is immobilised by polymerisation (Fig. 1).

While two-bottle self-etching adhesives have already simplified the adhesive procedure, single-bottle universal adhesives go the extra mile. It is a challenge to bring together components distributed in multistep systems in one bottle without compromising the stability of the product. Current technology now makes this possible. To seal the surface as soon as possible after application, the penetration of the monomers into the dental tissue must be fast and efficient.

However, the penetration is usually slowed down by monomers that need time to penetrate the tooth structure—especially wet dentine—and sometimes even need to be rubbed into it. That is why Kuraray Noritake Dental focused on developing the rapid bond technology. It utilises the original MDP monomer combined with newly developed hydrophilic cross-linking amide monomers and is integrated in CLEARFIL Universal Bond Quick. The hydrophilic amide monomers provide for rapid, deep and complete penetration of the dentine and form upon polymerisation a densely cross-linked polymer network responsible for a strong and durable bond. Hence, waiting and rubbing times are eliminated, and a tight and long-lasting seal of the cavity is established after light-polymerising (Figs. 2a & b).

Because of their hydrophilicity (water affinity), these amide monomers penetrate dentine very well. After light-polymerising, the bond exhibits low water absorption and therefore high ageing resistance.

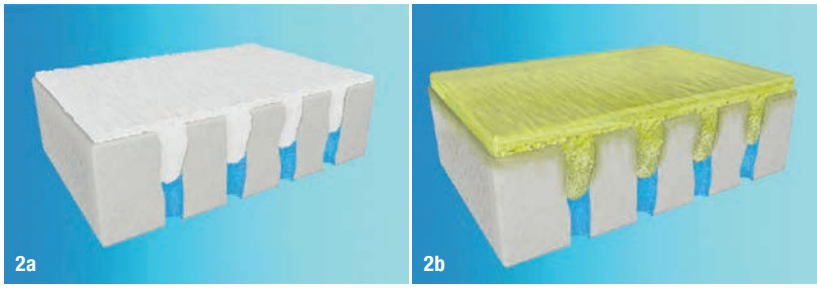


Fig. 2a: Prepared dentine with smear layer. Because of its hydrophilicity, very hydrophilic bonding is needed in order to be able to optimally penetrate the dentine. **Fig. 2b:** Dentine bonded with CLEARFIL Universal Bond Quick. During polymerisation, CLEARFIL Universal Bond Quick creates a highly cross-linked polymer network. As a result of this network, the bonding has very low water absorption, which produces a long-lasting restoration.

Optimising direct restorative materials

Combining multiple layers, shades and opacities—the use of highly complex layering techniques for the creation of lifelike composite restorations is luckily a thing of the past in many clinical situations. The reason for this is highly developed resin composites that blend seamlessly with the adjacent tooth structure. To provide for this favourable feature, Kuraray Noritake Dental developed its proprietary light diffusion technology. The technology is incorporated in special prepolymerised fillers that act like millions of microprisms that transmit and refract light and colour from the surrounding tooth structure. Optimised in size, distribution and refractive index in relation to the matrix, the fillers offer unsurpassed natural blending.

The whole CLEARFIL MAJESTY composite line-up employs this proprietary filler technology. Its latest product—CLEARFIL MAJESTY ES-2 Universal—in which Kuraray Noritake Dental uses next-level light diffusion technology, allows for a single-shade technique with simplified shade selection (Fig. 3). It is

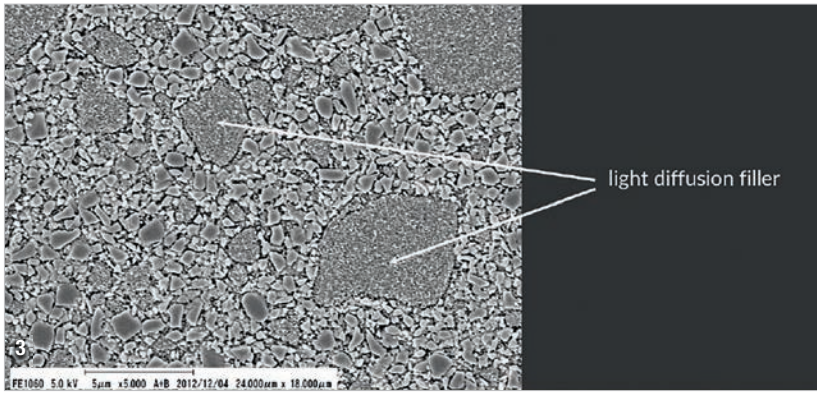
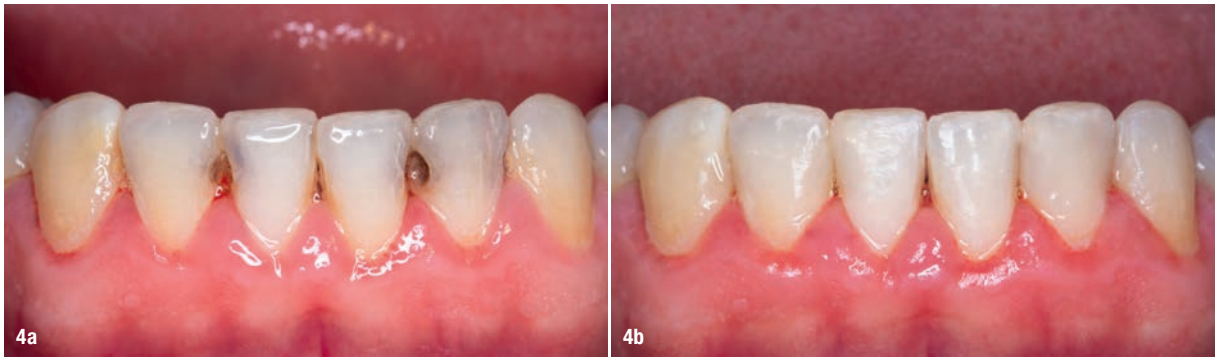


Fig. 3: Refracting and transmitting light for great optical integration: light diffusion fillers of CLEARFIL MAJESTY ES-2 Universal.



Figs. 4a & b: Example of a single-shade restoration made of CLEARFIL MAJESTY ES-2 Universal. Before **(a)**. After **(b)**.

available in two shades for the anterior and a single shade for the posterior region, but blends in so well that it covers virtually every shade of the VITA classical A1–D4 shade guide.

As a great optical appearance is not only dependent on optical integration and undetectable restoration margins, Kuraray Noritake Dental also developed fillers that provide for the rest—a natural surface gloss and long-term polish retention. The solution, integrated in CLEARFIL MAJESTY ES Flow with its three levels of flowability, is called submicron filler technology. It makes use of glossy submicron-sized fillers that are so small that light reflections show a natural effect even after wear. Kuraray Noritake Dental's exceptional silane technology is used to join millions of those submicron fillers and keep them together over time. It allows for high filler loads in the low-viscosity composites and limits water uptake that would otherwise lead to degradation of the polymerised composite. The perfect balance between the glossy submicron fillers, light diffusion fillers, resin matrix and proprietary silane technology is responsible for an optimal combination of mechanical and optical properties (Figs. 4a & b).

Conclusion

Adhesive monomers, filler technologies and silane technology providing for a solid combination of fillers, clusters and resin matrix—CLEARFIL MAJESTY ES-2 Universal clearly is a trusted line of products in the field of adhesive restoration (Fig. 5). The proprietary technologies developed during the past decades have definitely contributed to a better (long-term) performance of direct restorations and to reliable and aesthetic outcomes that are more easily achieved.

Fig. 5: CLEARFIL MAJESTY ES-2 Universal products.

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Treatment of a carious lesion with a composite with a single posterior shade

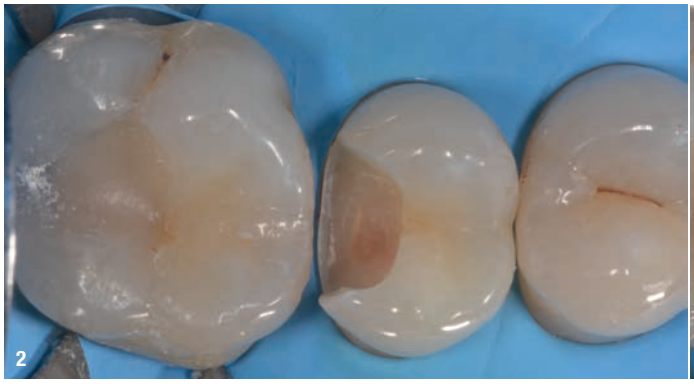
Dr Nicola Scotti, Italy

Fig. 1: Initial situation.

> "It offers good marginal adaptation, low shrinkage stress and high wear resistance, necessary for great long-term results."

When restoring posterior teeth with resin composite, functional aspects such as tight and anatomically correct proximal contacts and a naturally shaped occlusal surface that is wear-resistant and antagonist-friendly are even more important than perfect optical integration. This is why every dental practitioner should avoid spending a great deal of time on shade selection in these cases and focus on the factors that have an impact on the reliability and longevity of the restoration. Great support in accomplishing this task is offered by CLEARFIL MAJESTY ES-2 Universal (Kuraray Noritake Dental), a resin composite with a single universal shade (U) for the posterior region that eliminates the need for shade taking and selection. It offers good marginal adaptation, low shrinkage stress and high wear resistance, necessary for great long-term results.

The initial situation presented a wide primary carious lesion in the distal aspect of the second premolar (Fig. 1). The working field of the premolar was first isolated with a dental dam, and caries excavation and cavity preparation were performed (Fig. 2). A sectional matrix and a wedge were then placed to optimise the fit. Both were held in place with a separation ring, which increases the interproximal space and hence ensures tight, anatomically correct proximal contacts (Fig. 3). Build-up of the proxi-



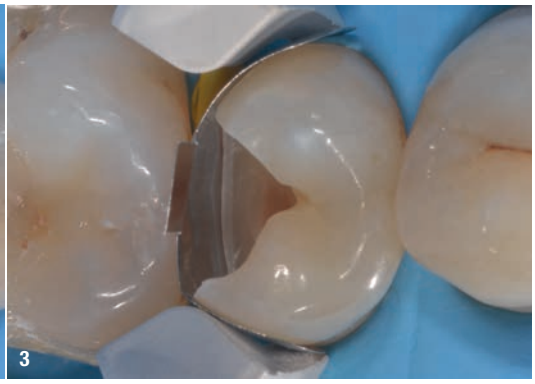


Fig. 2: The premolar after isolation with a dental dam, caries excavation and cavity preparation. **Fig. 3:** Placement of a sectional matrix and a wedge to optimise the fit.

Fig. 4: Build-up of the proximal wall with CLEARFIL MAJESTY ES-2 Universal (Shade U). **Fig. 5:** A thin layer of flowable composite (CLEARFIL MAJESTY ES FLOW High) applied to the cavity floor. **Fig. 6:** Restoration completed with CLEARFIL MAJESTY ES-2 Universal (Shade U). **Fig. 7:** Treatment outcome immediately after removal of the dental dam.

mal wall with CLEARFIL MAJESTY ES-2 Universal (Shade U) was then done, after selective enamel etching with phosphoric acid (K-ETCHANT Syringe, Kuraray Noritake Dental) and bonding with CLEARFIL SE BOND (Fig. 4). After that, a thin layer of flowable composite (CLEARFIL MAJESTY ES Flow High) was applied to the cavity floor to act as a resin coat (Fig. 5). Restoration was completed with CLEARFIL MAJESTY ES-2 Universal (Shade U). Although this composite blends in very well with the surrounding tooth structure, the natural look was finished off by adding a tiny bit of brown tint to the fissure (Fig. 6).

The restoration and soft tissue looked natural and healthy immediately after removal of the dental dam. The proximal contact was tight, and the occlusal anatomy well shaped for the patient's individual masticatory dynamics. The margin of the restoration was virtually invisible, but the buccal cusp appeared lighter because of dehydration of the natural tooth structure (Fig. 7). The final treatment outcome was very satisfying (Fig. 8).

Conclusion

The case presented demonstrates that the selected composite is well suited for simplified restorative procedures in the posterior region. The material handles well, offers the same mechanical properties as other materials from the CLEARFIL MAJESTY ES-2 series and blends in harmoniously with the surrounding structures without being too translucent. This way, it is possible to waive the shade taking process without compromising the treatment outcome. The time saved in this context may be spent on functional aspects—or even on another patient.

Fig. 8: Final situation.

about

Dr Nicola Scotti is an associate professor at the Department of Surgical Sciences at the University of Turin's dental school in Italy. His main interests are dental biomaterials, resin-based composites, CAD/CAM materials and adhesive dentistry.

Rethinking bonding in the adhesive dentistry era: Think universal

Dr Dimitrios Spagopoulos, Greece

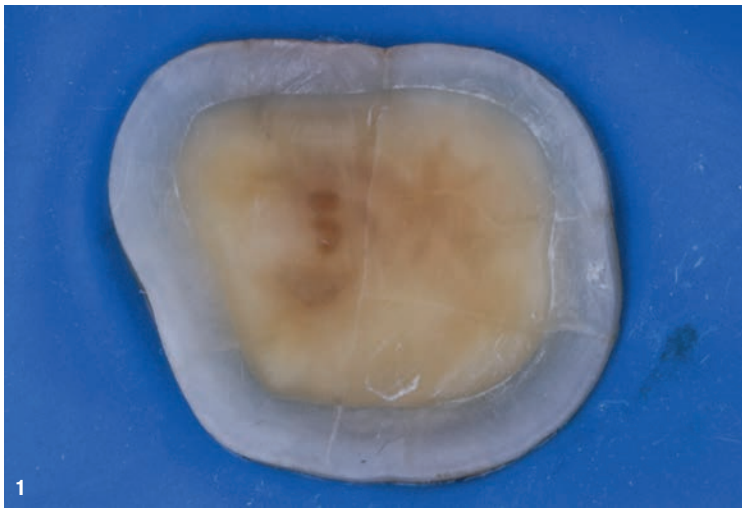


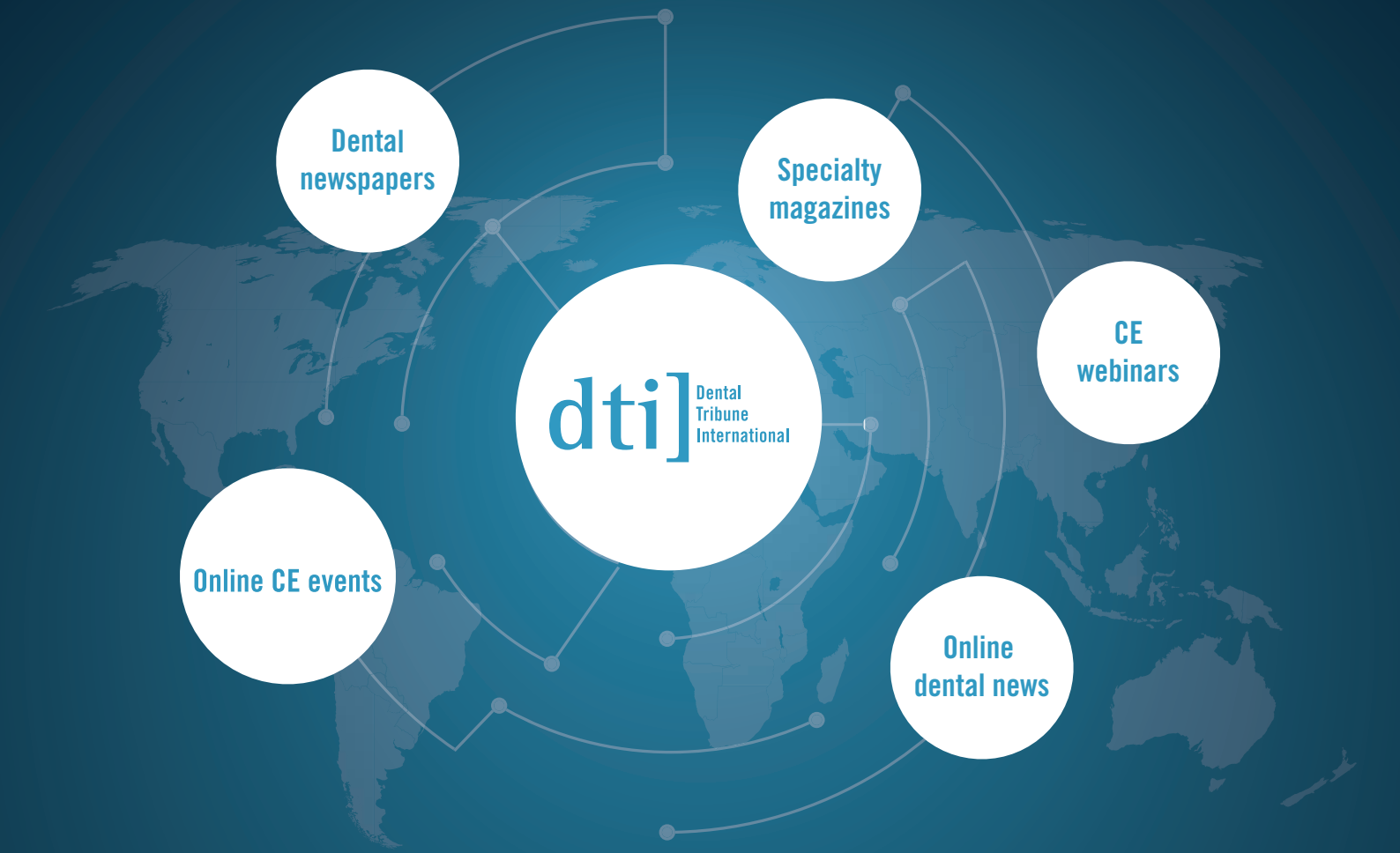
Fig. 1: A tooth prepared for an overlay. The outer enamel layer and inner dentine are optically easily distinguishable.

Introduction

When Buonocore presented the benefits for acid etching on bonding in the 1950s, it was the beginning of adhesive dentistry.[1] Direct composite restorations have evolved over the years, and contemporary materials offer versatile solutions in a variety of direct or indirect restorations. The vast progress that composites have undergone has made this material the most popular choice among restorative materials.

The key point for the restorative dentist is to achieve the best possible bond between dental substrate and the composite. Hereto, the anatomy of the tooth must be considered. In particular, it is important to examine the structure and composition of the two main tissues, enamel and dentine, to understand how they affect adhesive bonds (Fig. 1).

Fig. 2: G2-BOND Universal, consisting of 1-PRIMER and 2-BOND. Their yellowish colour reveals the presence of photoinitiator in both components. This colour disappears after the polymerisation reaction.



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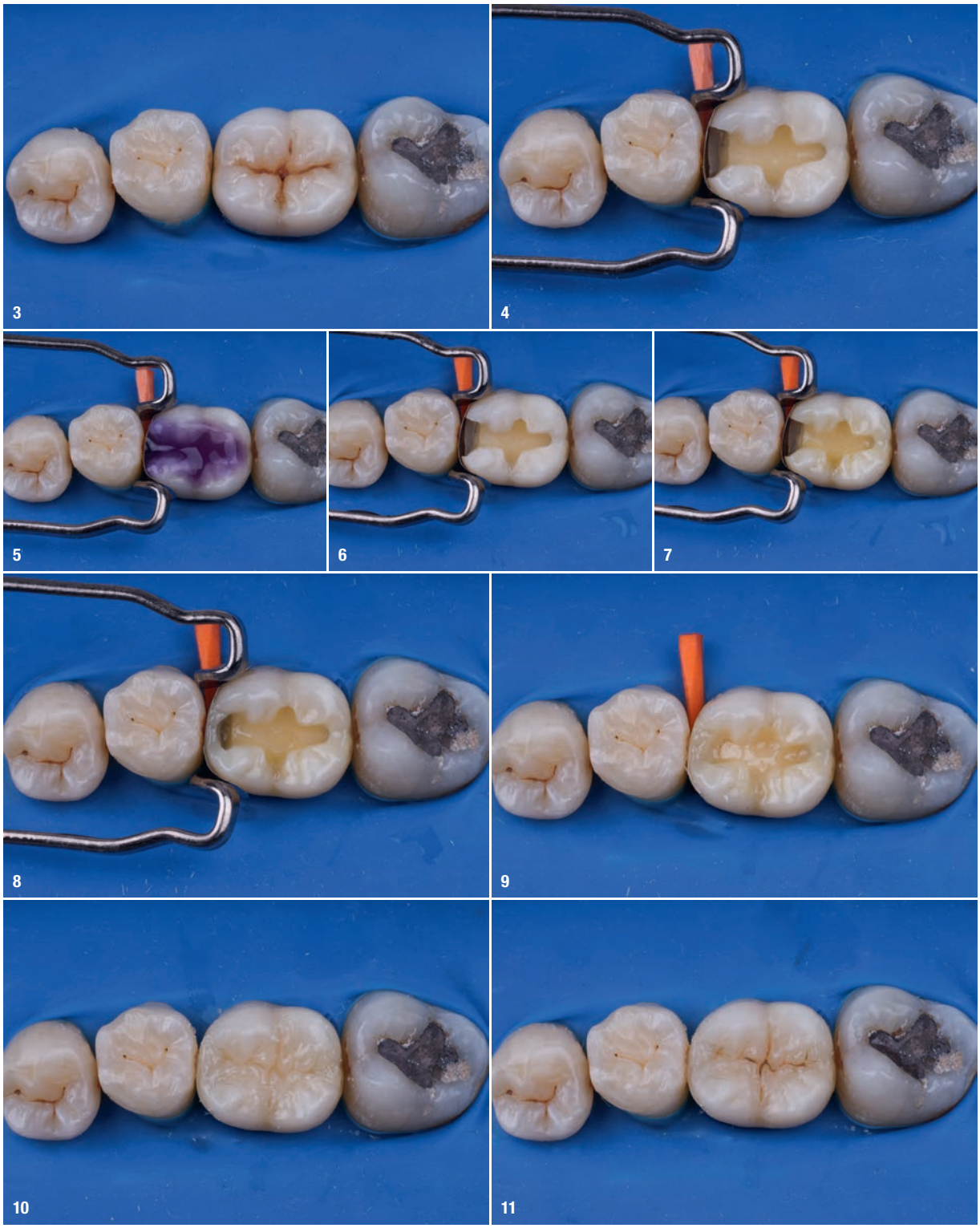

Fig. 3—Case 1: Mesial caries was discovered on the first mandibular molar after radiographic examination. The occlusal surface was scored as Code 3 according to the International Caries Detection and Assessment System II.[5] **Fig. 4:** A typical Class II mesiooccl usal cavity was prepared. **Fig. 5:** In this case, the total-etching technique was chosen. Prior to applying 1-PRIMER to enamel and dentine, a 35% phosphoric acid gel was applied. **Fig. 6:** Etching of the dental substrate gives it a frosty appearance. **Fig. 7:** It is recommended to use maximum air pressure to dry 1-PRIMER. Immediately after application of 2-BOND, a gentle stream of air is applied, and the adhesive is light-polymerised for 10 seconds. **Fig. 8:** G-ænial Universal Injectable (GC) was applied at the cervical margin of the restoration, followed by G-ænial A'CHORD in Shade JE in order to create a bubble-free approximal surface without voids at the margins. Both materials were co-polymerised at this stage. **Fig. 9:** One mass of G-ænial A'CHORD in Shade A4 was applied to replace the missing dentine. **Fig. 10:** A final layer of G-ænial A'CHORD in Shade JE was used in order to create natural morphology with the proper hue and value to replace occlusal enamel. **Fig. 11:** Stains can be used to give the look of a natural tooth, making the restoration inconspicuous.

Dentine differs from enamel in that it contains organic material and liquid within the dentinal tubules. In addition, the density of the dentine varies with depth. The water content of the dentine is lower in the superficial dentine and higher in the deep dentine.[2] Bonding to these surfaces is challenging.

Adhesives are composed of both hydrophilic and hydrophobic monomers. The main difference between hydrophilic and hydrophobic adhesives is the chemical composition of their monomers and solvents. The most commonly used monomers in adhesive systems are hydroxyethylmethacrylate (HEMA) and bisphenol A-diglycidylether methacrylate. HEMA converts the adhesive to a more hydrophilic system by absorbing water from the dentine or the oral environment,[3] consequently causing more discoloration at the margins of the restoration.

Any adhesive system that emerged during the past decades falls into one of two categories, based on its application: etch-and-rinse adhesives and self-etching adhesives. Universal adhesives have recently been introduced, and they are distinguished by their multi-mode application.

G2-BOND Universal (GC) is probably the best option when efficiency is desired without sacrificing bond longevity (Fig. 2). Based on thorough research, it contains all elements that are needed for an optimal adhesive performance.[4] The primer (1-PRIMER) allows it to be used as a total-etching adhesive or a self-etching adhesive system. 1-PRIMER contains MDP, providing enhanced chemical bonding to the tooth structure and indirect substrates such as zirconia and non-precious metals. Two additional functional monomers, 4-MET and MDTP, further ensure bonding to the tooth and precious metals, respectively. Unlike other adhesives, 2-BOND is hydrophobic and free of HEMA and MDP, what makes it very resistant to hydrolytic degradation and staining. However, a photoinitiator is present in both components. Even though the primer contains photoinitiator, it is not meant to be polymerised separately. The function of the photoinitiator is to ensure that the infiltrated resin can efficiently polymerise in all areas, including the deeper parts of the hybrid layer.

> "On enamel, the best adhesion is still obtained by first creating a micro-retentive pattern by means of acid etching."

The bonding protocol

On enamel, the best adhesion is still obtained by first creating a micro-retentive pattern by means of acid etching. The benefits of acid etching on dentine are more ambiguous. Two cases are discussed here in which different etching modes were chosen for specific reasons.

First clinical case: Total-etching mode (Figs. 3–11)

In this first case, the preparation of the cavity was rather shallow, and all margins were located in enamel. In such circumstances, it is important that a tight seal is obtained on the enamel margins, especially on the approximal surface which is most prone to recurrent caries. Therefore, a total-etching approach was chosen in this situation.

Second clinical case: Selective-etching mode (Figs. 12–22)

When a considerable amount of dentine is present in the cavity and especially on its margins, it is important that the adhesion to dentine is durable and prone to water degradation. Rigorous etching would expose the wet

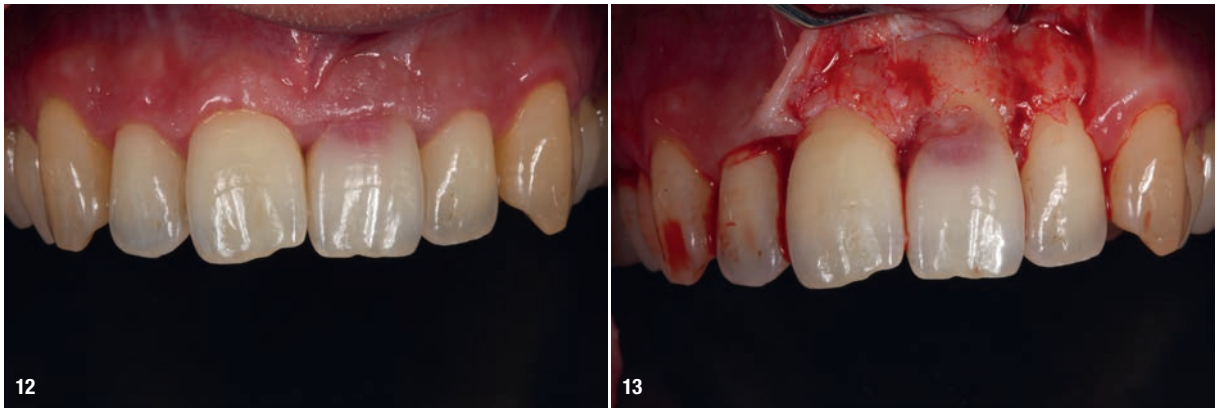

Fig. 12—Case 2: Initial situation, showing a supra-crestal external resorption at the central incisor. The tooth was still vital, giving the option of a direct restoration after raising a flap. **Fig. 13:** The cavity and the soft tissue were visible after the gingival flap had been raised, making it easy to clean the area and place a dental dam.

Fig. 14: Dental dam isolation protects the operative field from humidity and contamination. **Fig. 15:** It is important to remove the unsupported enamel in order to avoid cracks during light polymerisation. **Fig. 16:** Selective etching of the enamel with 35% phosphoric acid. The thickness of the dentine overlying the pulp was not more than 0.3 mm. **Fig. 17:** Prior to light polymerisation, 1-PRIMER and 2-BOND were applied to both the enamel and dentine in accordance with the manufacturer's instructions. **Fig. 18:** Application of G-ænial A'CHORD in Shade A4 to replace the missing volume of dentine. **Fig. 19:** G-ænial A'CHORD in Shade AE was placed to complete the restoration. **Fig. 20:** It is important to finish and polish restorations—especially close to the periodontium—in order to obtain a smooth surface, which is vital for promoting healthy periodontal tissue. **Fig. 21:** Immediately after the completion of the direct restoration and flap closure. **Fig. 22:** The tooth was re-evaluated nine months after the surgery. The tissue had healed, and the restoration seemed completely integrated.

collagen in its protective mineral envelope. Moreover, etching dentine that is close to the pulp might cause irritation and inflammation of the latter. For these reasons, a selective-etching approach seems safer in such cases. Here, the enamel was etched at the incisal cavity margin to optimise micromechanical interlocking and to avoid discoloration, whereas on the cervical margin, the dentine was bonded after a self-etching approach.

Conclusion

G2-BOND Universal ensures a strong, durable bond and is versatile in its use. As a consequence, dentists can reduce their armamentarium and do not need to remember the different protocols that need to be used for different adhesives, yet can still count on maximal bonding performance. It is a valuable asset for any dentist unwilling to accept a trade-off.

Editorial note: A list of references is available from the publisher.

about

Dr Dimitrios Spagopoulos graduated from the School of Dentistry of the University of Athens in Greece in 2012 and the next year completed an MSc in aesthetic and restorative dentistry at the same university. Since 2012, he has been a clinical instructor at the dental school. Since 2015, he has practised at the Periocare Goumenos dental clinic in Athens, where he exclusively focuses on aesthetic dentistry, prosthodontics, restorative dentistry and implants. He also practises in these fields in his own private clinic.

Dr Spagopoulos is part of the editorial team of the *dentorama* and *dental journal* magazines (Omnipress) and is a member of the European Academy of Esthetic Dentistry and the European Association for Osseointegration. He is a key opinion leader for Hu-Friedy.

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BORN IN JAPAN

New philosophies in ceramic layering

Joaquín García Arranz (Quini) & Dr Ramón Asensio Acevedo, Spain

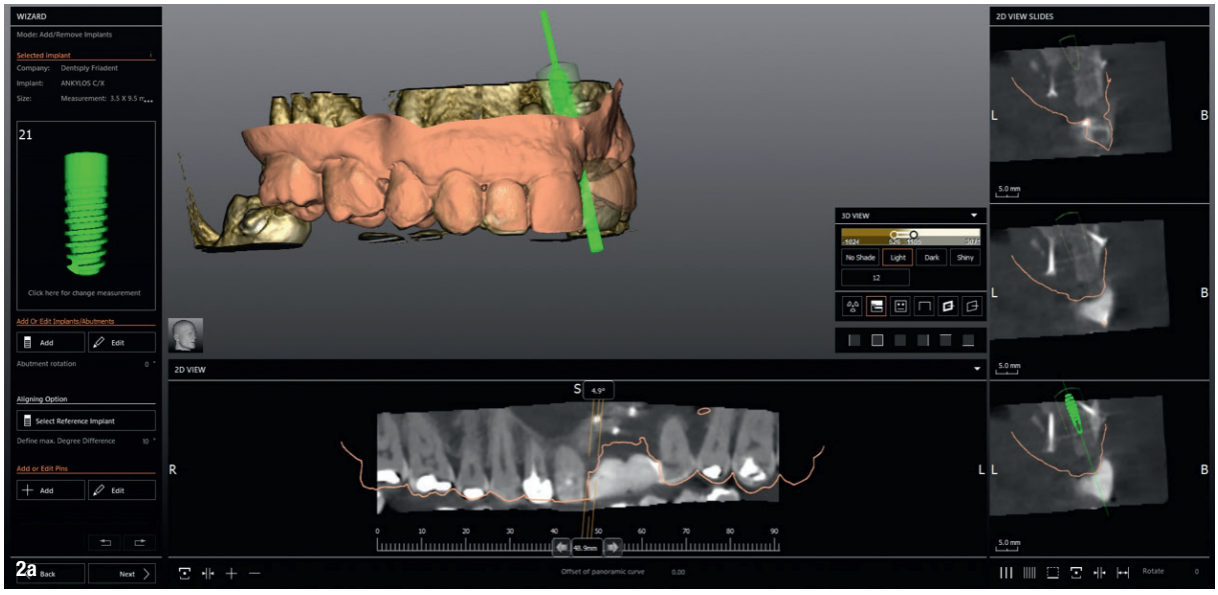
Figs. 1a–c: Initial situation. Frontal view **(a)**. Right lateral view **(b)**. Left lateral view **(c)**.

Introduction

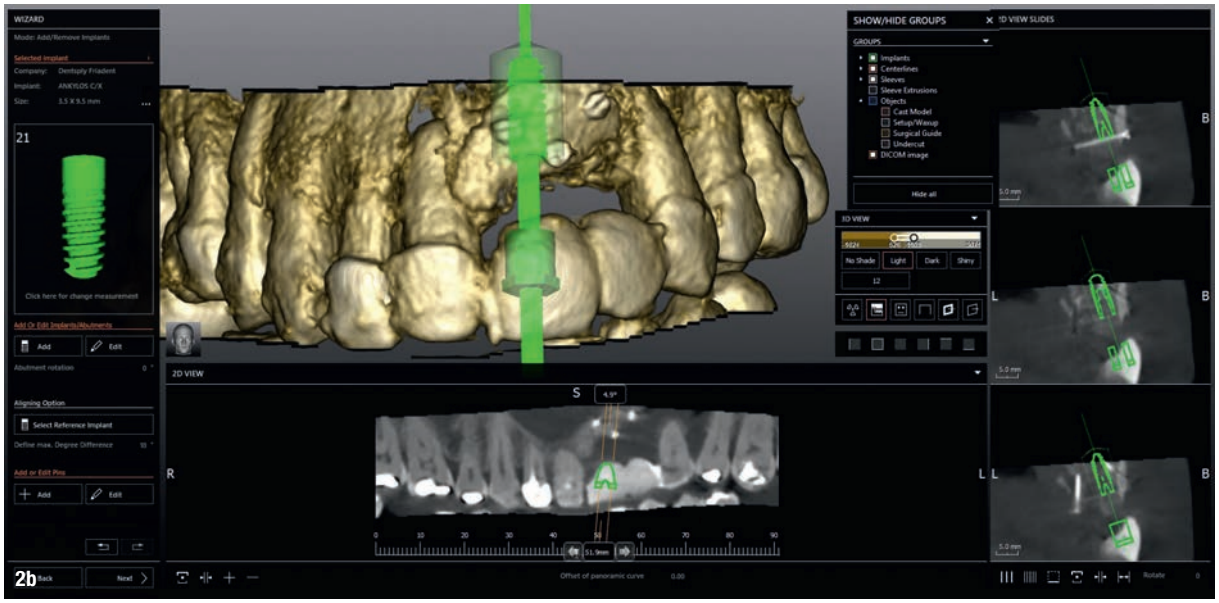
Micro-layering is a solution that combines full-contour ceramics with a very thin layer of veneering ceramic in the buccal aesthetic zone. With current CAD methods, a buccally reduced restoration is quickly modelled. With the right materials, colour deepness and natural translucency can be obtained within a space of about 0.2–0.6 mm. Hence, the strength of the framework remains where needed, and within this small space, colour, shape and microtexture are easily controlled.

Diagnosis and treatment plan

The patient consulted because he was dissatisfied with his smile. He also mentioned pain in the maxillary anterior area. During the clinical examination, it was noted that left lateral incisor was absent, which had resulted in a large midline shift in the upper jaw. A fixed porcelain-fused-to-metal restoration was present on teeth #12, 11 and 21. Tooth #21 had suffered a periodontal loss of attachment, and a large vestibular gingival recession was present (Figs. 1a–c). The dental situation was causing occlusal instability, inadequate function and poor aesthetics.



Figs. 2a & b: Digital planning of the surgical phase.



The treatment plan consisted of an initial prophylactic phase, including oral hygiene instructions, and extraction of tooth #21, and all necessary actions would be taken to stabilise periodontal health. Once stabilised, a second phase would be carried out, in which orthodontic aligners would be used to correct the midline shift and to redistribute the spaces for placing an implant at the locus of tooth #21 (Figs. 2a & b).

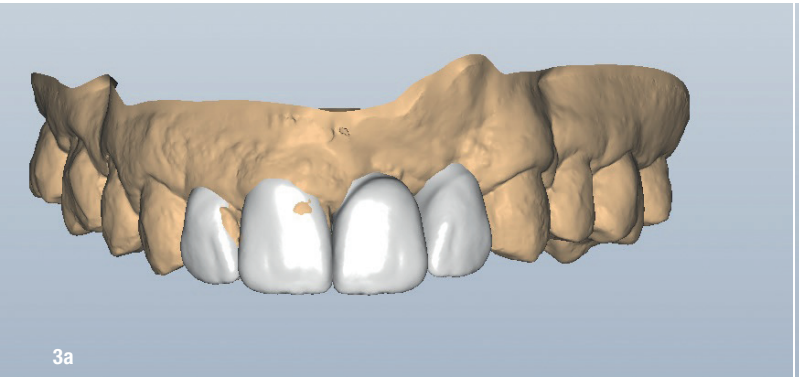
The last phase would consist of the prosthetic rehabilitation of the maxillary anterior teeth with veneers on teeth #13 and 23, a cantilever bridge from tooth #12 to a pontic in the locus of tooth #22 (Figs. 3a & b).

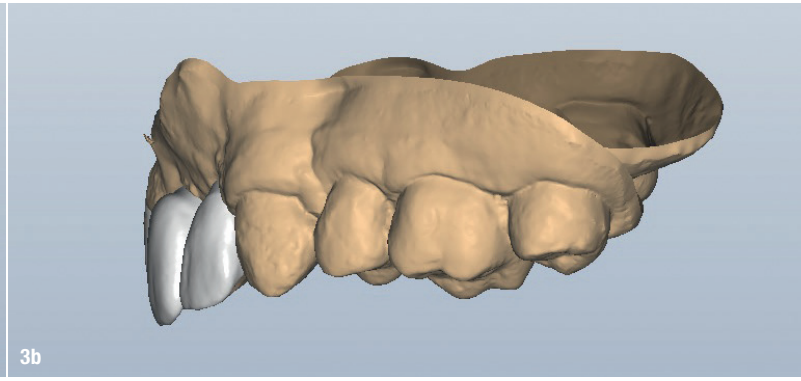
In such a case as this one that combines teeth and implants in the anterior region, it is important to select the most suitable restorative material in terms of strength and aesthetics and to carefully consider the restorative design, obtaining the maximum implant integration and efficiency.

> "With the right materials, colour deepness and natural translucency can be obtained within a space of about 0.2–0.6 mm."

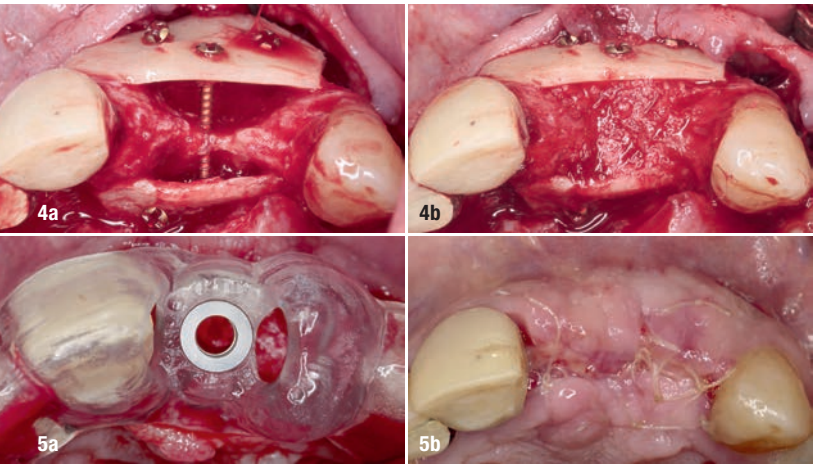
Surgical intervention

After orthodontic treatment with aligners, the marked bone defect caused by a long-evolving infection at the locus of tooth #21 was regenerated. For this intervention, autologous bone was chosen for the guided bone regeneration, being considered the gold standard. The split bone block technique, initially described by Khoury and Hanser, was used.[1] This technique





Figs. 3a & b: Digital planning of the prosthetic restoration. Frontal view **(a)**. Left lateral view **(b)**.



Figs. 4a & b: Horizontal ridge augmentation with autologous bone using the split bone block technique.[1] **Figs. 5a & b:** Guided implant surgery, during **(a)** and after **(b)** surgical procedure.

consists of obtaining a bone graft of the mandibular ramus that is subsequently divided into two cortical sheets that are fixed in the defect area by screws, and then autologous bone scraped from the bone graft is placed between the two sheets. The intervention is concluded with a tension-free closure using sutures (Figs. 4a & b).

Four months after the horizontal ridge augmentation, the implant was placed in the regenerated area using guided surgery (Figs. 5a & b). When this area was exposed, a horizontal gain of bone was found. After implant placement, the volume of soft tissue was optimised by two connective tissue grafts; one from the palate and one from the tuberosity region.

Restorative design

A standard prefabricated abutment that could be modified by grinding was chosen (Fig. 6a). Small modifications were made that were of great importance. The abutment was customised by undercontouring the subcritical area as much as possible, modifying the margins, especially the mesial margin, and lengthening the distal area to have sufficient support for the secondary structure to rest on (Fig. 6b).

Zirconia was chosen for the restoration framework from tooth #12 to pontic #22. This material allows under-contouring of the design in the subcritical area of the emergence profile as much as possible, following the design of the abutment interface to create a fully polished, seamless profile and thereby providing a smooth surface in contact with the mucosa. In the design, the full volume was kept on the palatal side to ensure a durable restoration over time and to avoid chipping due to protrusive or lateral movements. Coloured zirconia of the same substrate or nuance of the patient's base dentine, which was Shade A3, was used. A micro-reduction of about 0.2–0.3 mm was created at the vestibular side for future microstratification (Fig. 7). Once sintered, the framework was prepared on the model and the occlusion verified. It was then ready for micro-layering.

Characterisation: Internal staining

Nowadays, a wide range of possibilities exist for the characterisation of ceramic restorations. The combination of GC Initial IQ Lustre Pastes ONE and GC Initial Spectrum Stains provides the ability to establish all colour effects, both internally and externally. A great difference can be seen in comparison with the older paints and stains, there being much more luminosity and incredible fluorescence (Fig. 8).

The internal staining was done with this combination to intensify some colour details. To mimic the mamelon

Figs. 6a & b: The standard abutment prior to modification **(a)** and after modification **(b)**.

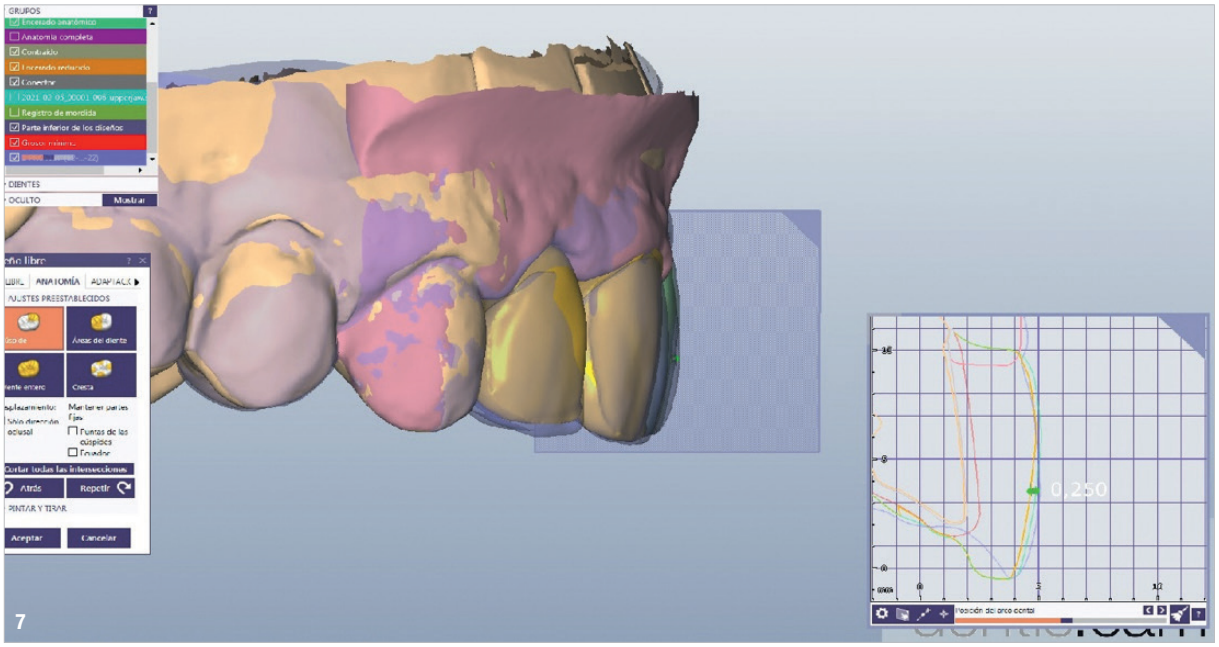


Fig. 7: Digital design of the restoration framework in zirconia.

structure, a combination of SPS-13 (Twilight) and SPS-16 (Midnight) was used. Next, the incisal halo was accentuated using a mixture of SPS-1 (Ivory White) and SPS-2 (Melon Yellow).

Mesial and distal of the incisal edge, L-A (Body A) mixed with either SPS-2 or SPS-4 (Light Terracotta) was applied alternately for bright contrast and saturation, respectively. Further mesially and distally up to the cervical margin, L-6 (Dark Blue) was used. In the middle and cervical thirds, L-B (Body B) was used to give the zirconia framework a bit more saturation. Here, SPS-13 was used on either side of the centro-facial lobe to further accentuate the developmental depressions towards the cervical aspect.

Layering: Form and texture

Once the Lustre Pastes have been fired in the furnace, all colours are fixed in place and serve as a connection layer. Depending on the chosen shade, this can be done in multiple firings. After the internal characterisation, a texturising ceramic material (GC Initial IQ SQIN) that was introduced together with Lustre Pastes and Spectrum Stains as a new innovative concept was used to add shape, texture and gloss. A great advantage of this concept is that the same ceramic can serve for different restorative materials, such as zirconia and lithium disilicate.

The area of the mamelons was layered with Translucent TO (Opal Booster) combined with the enamels E-57 to E-59. Translucent TO was also used for the line angles of the teeth. Since the zirconia was pre-

> "A great difference can be seen in comparison with the older paints and stains, there being much more luminosity and incredible fluorescence."

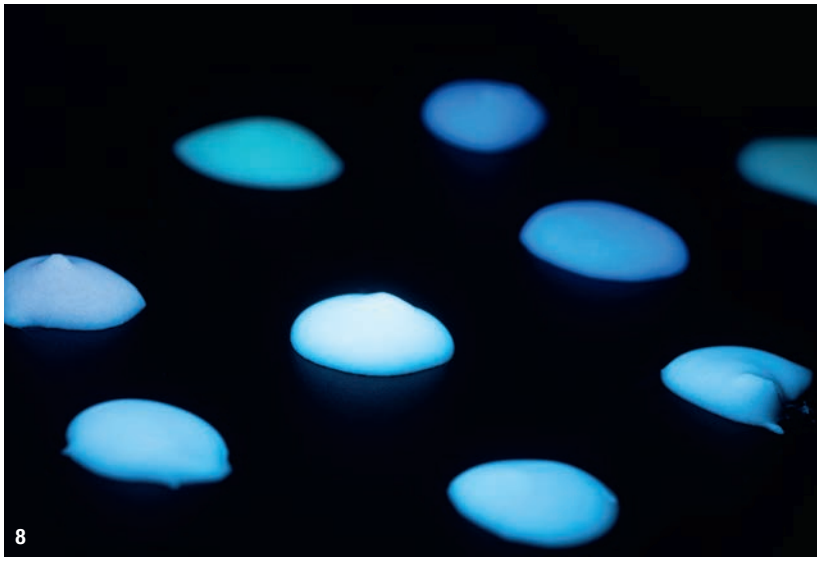
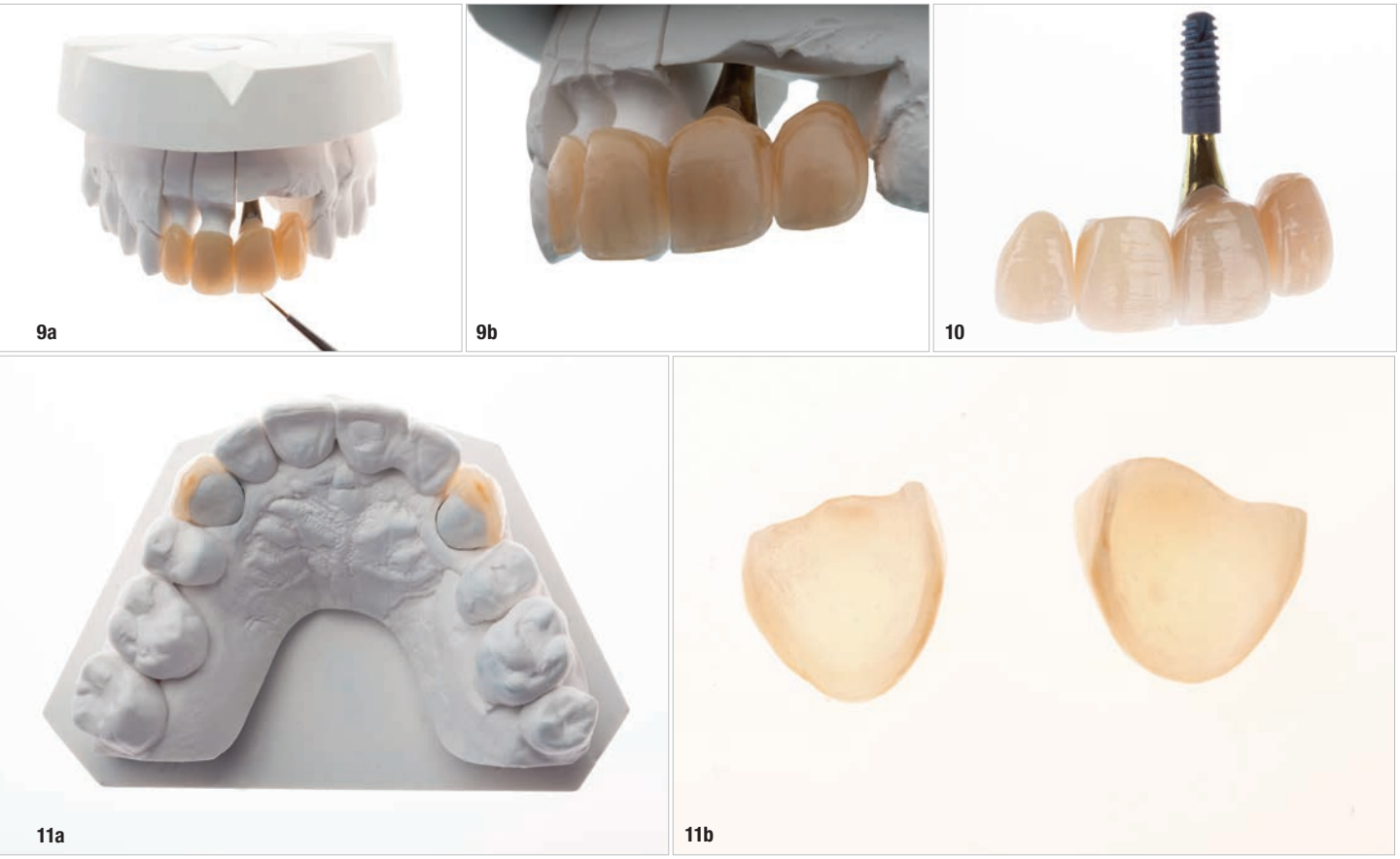


Fig. 8: Fluorescence of the GC Initial IQ Lustre Pastes ONE.



Figs. 9a & b: Zirconia framework after adding colour with a mixture of GC Initial IQ Lustre Pastes ONE and GC Initial Spectrum Stains. Frontal view **(a)**. Close-up **(b)**. **Fig. 10:** The finished zirconia restoration, characterised with the GC Initial IQ ONE SQIN system. **Figs. 11a & b:** Lithium disilicate veneers for teeth #13 and 23, characterised with the GC Initial IQ Lustre Pastes ONE and GC Initial Spectrum Stains from the same GC Initial IQ ONE SQIN system as was used for the zirconia bridge. On the model **(a)**. Individually **(b)**.

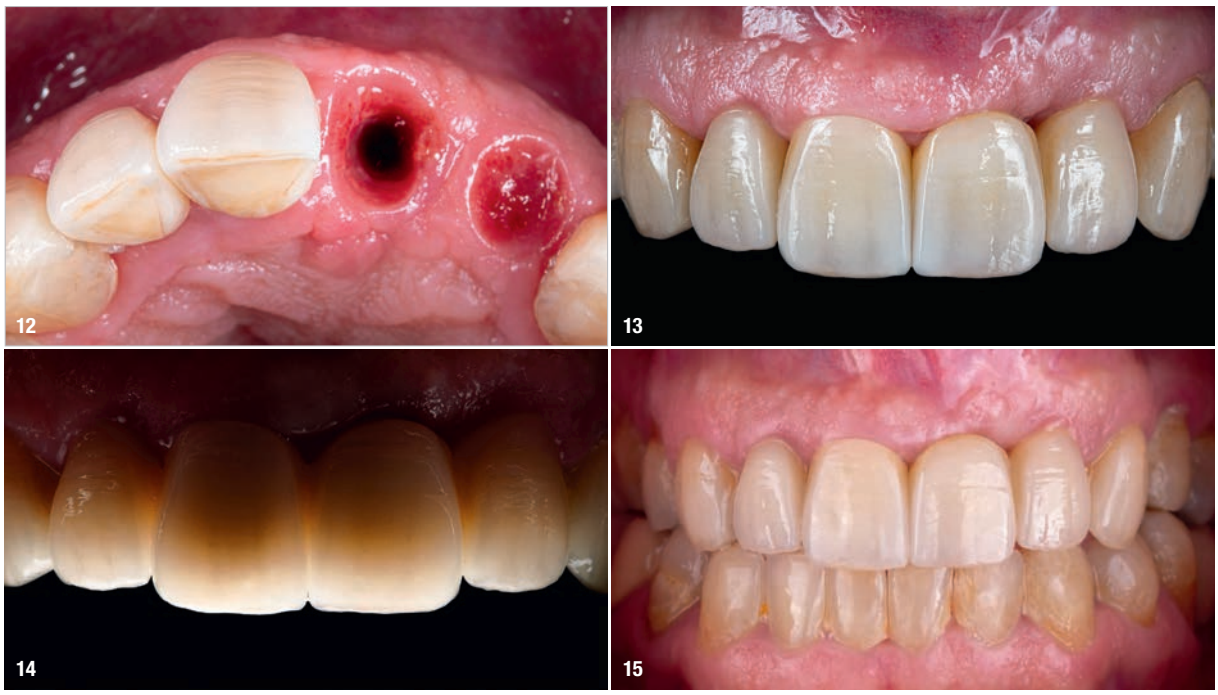


Fig. 12: Occlusal view after removal of the provisional screw-retained restoration, showing the gingival architecture obtained. **Fig. 13:** Frontal view after placement of the restorations. **Fig. 14:** Transillumination of the restorations. **Fig. 15:** Frontal view of the final result, showing natural-looking and harmonious dentition.

coloured in the base colour, there was no need to add dentine ceramic; only a thin enamel layer was applied (Figs. 9a–10).

The SQIN ceramics are much easier to handle than conventional ceramics, as the feeling on the brush is very consistent. Owing to the Form & Texture liquid, it remains on any surface on which it is placed, and compared with other ceramics, there is virtually no shrinkage. In the case of zirconia, the restoration is fired at a temperature of approximately 760 °C, depending on the furnace.

In the final phase, lithium disilicate veneers were made on the canines, combining the Lustre Pastes with the Spectrum Stains (Figs. 11a & b).

The great advantage of the micro-buccal layering is that adding texture is much easier than on full-body lithium disilicate or zirconia, which is more difficult to manipulate because of its extreme hardness, even though SQIN is denser than conventional veneering ceramics. It allows control of the luminosity and the fluorescence, creating a noticeable difference in black light or fluorescent light after the surface has been finished, making it resemble the natural tooth (Figs. 12–15).

Gingiva

The SQIN gingival shades enable the use of ceramics for atrophied jaw restorations for which pink aesthetics are needed. Combined with the Lustre Pastes gingival shades, the main colour is intensified first (Fig. 16a). This system enables micro-layering with the same philosophy as for the white aesthetics with different shades of colour, adding subtle contrasts by employing differently shaded masses and adding details to the surface (Fig. 16b), such as an orange peel effect (Fig. 16c).

Conclusion

The Lustre Pastes characterisation serving as a connection layer, the SQIN ceramics refining the form and texture, and the Spectrum Stains enabling infinite shade variations, only a minimal cutback on the vestibular part is needed to control the texture, fluorescence and transillumination in order to mimic natural teeth. Following the same concept for pink aesthetics by employing the gingival shades provides a complete layering concept.

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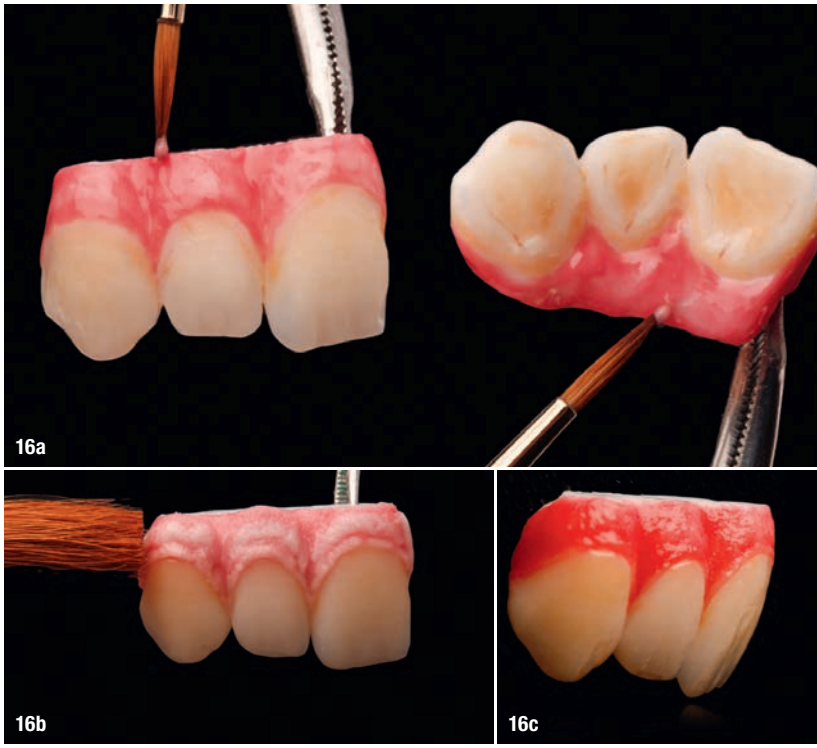


Figs. 16a–c: Adding colour to the gingival area with GC Initial IQ Lustre Pastes NF GUM shades **(a)**. Adding texture with the GC Initial IQ SQIN GUM shades **(b)**. The finished gingival area showed a desirable orange peel effect **(c)**.

about

Joaquín García Arranz (Quini) is the founder of the Ortodentis dental laboratory in Madrid in Spain, director of the Dental Training Center in Madrid by Quini and founding partner of the Fresdental fabrication centre in Alicante in Spain. He lectures in the master's degree programme in implants at the European University of Madrid and in the master's degree programme in prosthetics for dental technicians at Vericat Formación's training centre in Madrid. He is an opinion leader for GC Iberica.

Dr Ramón Asensio Acevedo holds a DDS from the Alfonso X el Sabio University in Madrid in Spain and a master's degree in aesthetic and restorative dentistry and a master's degree in interdisciplinary aesthetic rehabilitation, both from the Universitat Internacional de Catalunya in Barcelona in Spain. He is in private practice in Madrid, Barcelona and Toledo in Spain and an assistant professor in the aesthetic dentistry, endodontics and restorative dentistry department at the Universitat Internacional de Catalunya.

Making a permanent difference with zirconia paediatric crowns

A five-year follow-up

Dr Ana Vînău, Romania

Patricia first came to our clinic with her mother when she was 7 years old. She was quite shy, and I could tell that she felt very uncomfortable. Her mother told me that her daughter had experienced a great deal of dental pain before at another dental clinic and did not want to endure a similar experience again.

When examining Patricia, I could see that several of her teeth were affected by caries. I could see that teeth #75 and 85 were the most affected, showing evidence of massive dental destruction. I noticed that tooth #85 also had a vestibular abscess. I was almost certain that we would need to extract those teeth owing to the extensive damage. Furthermore, the lesions had already led to infection.

At the next appointment, I examined the panoramic radiograph so that I could see all of Patricia's teeth and assess the amount of root resorption in order to know how to treat her teeth. Upon viewing the radiograph, I was surprised, disappointed and challenged all at the same time. I saw that the respective permanent teeth were missing and noted accompanying extensive bone damage (Figs. 1 & 2). Patricia's parents were shocked and discouraged when they found out that she had hypodontia in addition to caries-affected primary second molars.

I knew right away that I needed a second opinion on this case, so I asked orthodontic specialist Dr Teodorina Secara for some advice. She advised me to try to keep the two damaged teeth in Patricia's mouth if at all pos-

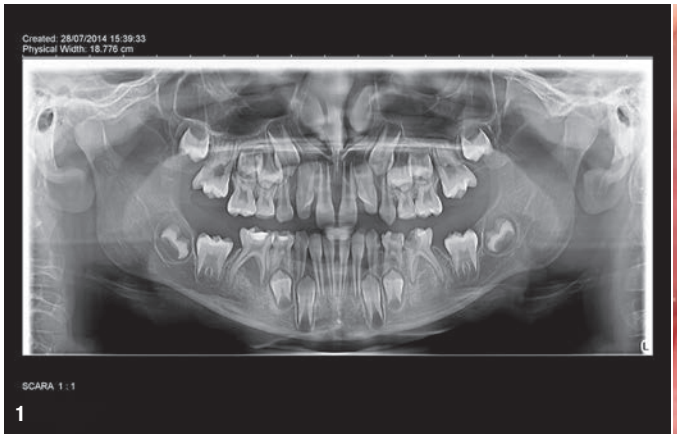


Fig. 1: Initial situation, panoramic radiograph. **Fig. 2:** Initial situation, clinical photograph.

sible, given the fact that she already had too much space between her teeth. The loss of these two primary molars would disrupt the relationship between the rest of her teeth and, in the end, impact her entire occlusion.

I took on the task of resolving this case as a personal challenge. Because the permanent adult teeth were missing, we could not afford to lose the primary second molars. I did not know how this case would end up, so I started by taking it one step at a time. In the beginning, I treated the root canals of the two damaged and infected teeth with antibiotics and anti-inflammatory medication.

After ten days, I filled the root canals of both teeth using the standard procedure for permanent teeth. On tooth #75, I also encountered a furcal perforation, and although it was very difficult to stop the haemorrhage, we managed eventually to place mineral trioxide aggregate on the perforation. We filled tooth #75 with EQUIA (GC) and tooth #85 with GRADIA DIRECT (GC).

Two weeks later, while I was treating the rest of Patricia's teeth, I saw through the enamel that tooth #75 had begun to turn black underneath the EQUIA filling. Also, tooth #85, owing to the extensive filling and the small amount of healthy dental structure remaining after removing the carious tissue, had begun to exhibit fissure lines. It was just a matter of time until that tooth would break, requiring an extraction, in spite of all the hard work done to save it. This was not a scenario I was willing to accept. At that point, I knew I had to come up with an alternative idea in order to help retain the primary second molars, and I had to do it fast.

I knew I had to reinforce these damaged molars if we wanted to keep them, but what I most wanted for Patricia was an aesthetic solution for her situation that would prove durable over time, because these primary molars would never be replaced by permanent teeth. In addition to being aesthetic, the ideal restoration would need to be extremely strong, able to withstand all occlusal forces over a lifetime. At the time, we only had stainless-steel crowns available in our clinic, but they would not be an option. I refused to believe that I had reached the end of the road, so I began doing some research to find out what aesthetic paediatric options were available.

I discovered that such a restorative option with all the characteristics that I had been hoping for did in fact exist. EZCrowns (Sprig Oral Health Technologies) would satisfy both the needs of my patient and the desires of her parents. Usually, when you diagnose a young patient with hypodontia and talk to the parents about it, they perceive the diagnosis as a handicap, or they feel ashamed for having done something wrong that led to the situation. Now, however, it was such a joy and a relief to be able to share the option of using zirconia crowns when faced with such a difficult circumstance.

> "I was impressed by the fact that both crowns looked so natural that you could barely notice any difference between the zirconia crowns and natural teeth."

After assessing Patricia's situation, I shared the good news of my discovery with her parents and proposed using EZCrowns. They were excited about the fact that the crowns had the same colour as natural teeth and gave me permission to proceed. I told Patricia that she

Figs. 3a–d: Eighteen-month post-op clinical photographs **(a & d)** and radiographs **(b & c)**.

would no longer feel any pain. She was excited to learn that instead of two damaged teeth, she would be getting two beautiful pearl-like teeth.

Anticipating the treatment, I was nervous because this would be the first time I had ever used zirconia crowns. However, I managed to seat both crowns in the same session. In the end, Patricia was extremely excited with the result. During the entire process of discovering zirconia crowns and preparing for the treatment, I found the Sprig team to be most helpful and responsive in communicating with me.

At Patricia's two-week check-up, I was surprised to see how beautifully the gingival margin had healed and to discover that the crown contour was nearly perfect. I was impressed by the fact that both crowns looked so natural that you could barely notice any difference between the zirconia crowns and Patricia's natural teeth. I was thrilled with the result and so were her parents, but what I most anxiously wanted to see was how well these crowns would perform over time. Would my patient be able to retain these two crowns over the long term?

Therefore, I monitored the crowns to see how they would hold up after prolonged use. I saw Patricia regularly for follow-up examinations and carefully examined her. At the six-month and 18-month follow-up appointments, I took photographs and radiographs of her teeth (Figs. 3a–d). They still looked impeccable. Her permanent first molars had erupted in their right places. I could not detect any wear of the opposing teeth, and the crown margins were subgingivally placed, revealing healthy surrounding tissue. The radiographs showed that the bone had remineralised and healed.

In summary, Patricia uses her new crowns as if they are her natural ones. After we placed the zirconia crowns, Patricia began taking personal responsibility for and paying more attention to proper dental hygiene. She now enjoys coming to her appointments because she knows we will take photographs every time. I think zirconia crowns are a necessity in this kind of situation with missing permanent teeth.

I now feel confident recommending zirconia crowns to parents, and these crowns enable me to honour the trust which parents have placed in me by providing the best available solution when treating special dental conditions such as hypodontia. By incorporating all the benefits of zirconia crowns into your practice, you too will increase your chance of success. Above all, you will have the professional satisfaction of knowing that you can overcome even the most difficult situation.

Every time, a patient revisits our clinic for a check-up appointment after a long absence, I feel a sense of excitement. I am eager to check each patient's dental status to see how the treatment plan we adopted has impacted his or her quality of life. Now, almost five years later, our choice to use zirconia crowns has been rewarded, and Patricia's teeth continue to look astonishingly natural (Figs. 4–6). Based on the latest radiographs taken during

Figs. 4–6: Five-year follow-up clinical photographs.

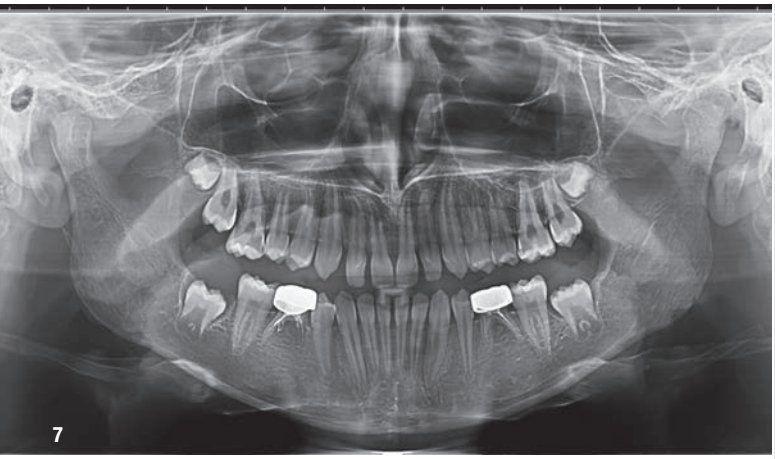


Fig. 7: Five-year follow-up panoramic radiograph.

a recent follow-up examination (Fig. 7), I can confirm that the final results continue to look amazing, despite the rough start. Patricia, who is almost 12 years old now, is no longer shy, and I can tell by the brightness of her smile that she is full of confidence. Since her initial visit, she has developed into a young girl with abundant enthusiasm and is not the timid child who first stepped into our office (Fig. 8).

As the *pièce de resistance* of the treatment, the EZCrowns have literally demonstrated their quality. Although both primary second molars were treated endodontically as if they were permanent teeth and the mesial root of tooth #85 shows evidence of resorption, Patricia has experienced no clinical symptoms.

The contour of the gingival margin is still placed at a physiologically appropriate height. Compared with Patricia's natural teeth, there are only insignificant signs of gingival inflammation, likely due to her still superficial personal dental hygiene habits.

One of my greatest concerns when I initially placed Patricia's zirconia crowns was how they would hold up over the long term. Would they be abrasive and damage the opposing natural teeth? Although zirconia crowns are glazed and smoothly polished, they still have a harder surface than natural teeth do. However, to my surprise, every time Patricia arrived for a clinical examination, I was unable to observe any notable pathological sign of dental abrasion on her opposing teeth.

Today, Patricia has no difficulties with her mastication or occlusion. Furthermore, and most importantly, she enjoys the amazing aesthetics of a beautiful smile. She has excellent oral health, and when I talk to her, I sense her feeling of well-being at having a beautifully restored smile. Although both molars had a guarded prognosis, five years later, we are still pleased with the results of her zirconia restorations.

Fig. 8: Happy patient with her dentist.

about

Dr Ana Vînău received her dental degree from the "Victor Babeș" University of Medicine and Pharmacy in Timișoara in Romania and holds a master's degree in periodontics. She is also currently studying for another master's degree in orthodontics. She works as a paediatric dentist at the DENT ESTET 4 KIDS clinic in Timișoara.

Laser protocol for peri-implantitis treatment

An interview with Dr Michał Nawrocki

By Dental Tribune International


Dr Michał Nawrocki

Laser is becoming essential for every modern dental practice. Moreover, from an educational standpoint, there are many benefits in terms of the personal and professional development of the practitioner. In this interview, Dr Michał Nawrocki explains how laser dentistry has helped to advance his practice and career and why dental laser, and Fotona's LightWalker in particular, has become an essential part of his daily practice.

Dr Nawrocki, you have been using laser technology since 2016. Looking back at your journey as a laser dentist, how has LightWalker impacted your everyday practice?
I started my great adventure with Fotona's LightWalker in 2016. Before that I had used a diode laser, but it was insufficient for me, and to be honest my knowledge of lasers, physics, indications and procedures was incomplete at the time. Then in January 2016, I invited Dr Ilay Maden to my clinic to conduct a course and teach my colleagues and me about various Er:YAG and Nd:YAG procedures with the LightWalker laser. A few months later, I decided to extend my knowledge about lasers by attending the Master of Science in Lasers in Dentistry presented by Prof. Norbert Gutknecht in Aachen. Now, I cannot imagine continuing my daily practice and treatments without having LightWalker. Sometimes, I use it as an additional tool during certain procedures, but very often it's a crucial and necessary tool for me to use to conduct a particular procedure.

What procedures do you perform with laser?
Laser can be used in all fields of dentistry; however, I am mainly focused on implantology and surgery, as well as prosthodontics. In prosthodontics, it can be used for sulcus conditioning, preparation for veneers and removal of complete ceramic crowns, as well as during more challenging procedures like crown lengthening before tooth preparation. We can use it in gingivectomy (Nd:YAG laser) and bone recontouring (Er:YAG laser).

All my surgery cases are finished with photo-biomodulation using the Nd:YAG Genova handpiece. I have observed that wound healing is much faster and better in such cases owing to pain reduction, disinfection, reduction of oedema and the laser's analgesic function. Sometimes, I have to conduct an endodontic treatment during the procedure (which is quite rare and normally done by my colleagues), in which case I really appreciate the deep disinfection with Nd:YAG, which offers the highest bacterial reduction in comparison with other wavelengths, and the Er:YAG SWEEPS (shock wave-enhanced emission photoacoustic streaming) procedure, which provides the most effective cleaning and disinfection. With surgical treatments, I use both wavelengths in almost all cases. Even when performing an easy and fast tooth extraction, I can use Er:YAG for granulation tissue removal, followed by Nd:YAG for disinfection, clot stabilisation and finally photo-biomodulation. Of course, I use laser before implant insertion, as well as when complications appear.

In your opinion, what are the main benefits of choosing a laser system that includes two complementary wavelengths, such as Er:YAG and Nd:YAG, especially in the field of oral surgery?
Very often, we combine these two wavelengths to conduct treatment in a fast, safe and predictable way. For me, it's crucial to use these two complementary wavelengths—the interaction between the tissue and laser beam is quite different, and owing to these differences in absorption, transmission and scattering, we obtain different actions. For example, during root apicectomy, after flap elevation, I remove granulation soft tissue with the Er:YAG laser using the H14 handpiece with a cylindrical tip (or when I want to be more precise—a Varian tip) and the apicectomy is done with the H02 non-contact handpiece. As the next step, I conduct deep disinfection with the Nd:YAG laser (transmission in hydroxyapatite and absorption in pigmented bacteria) before bone augmentation. Finally, I finish the treatment with photo-biomodulation using the Nd:YAG laser. As you can see from this example, I need both of these two complementary wavelengths to achieve final success with fast healing and proper bone regeneration.

One of your main fields of specialisation is implantology. Where does the laser fit in this field?
We can use LightWalker for all implantology cases. Sometimes, it's only needed for better and faster wound healing (photo-biomodulation with the Nd:YAG laser), but very often it is necessary to conduct the treatment. For me, it's the most important device during immediate implantation with immediate loading, especially when the bone must be very precisely cleaned of granulation soft tissue and disinfected. In the meantime, we can also provoke bleeding of the bone using the Er:YAG laser for superficial bone ablation. I also really appreciate the use of laser during bone grafting with the Khoury method. Sometimes, I combine this technique with immediate implantation, especially in the aesthetic zone. Then, after bone shield fixation, I can use the laser for bone recontouring. With the Er:YAG laser, it's done very precisely—I remove sharp edges and create an emergence profile for the crown—and most importantly, everything is safe for the shield (almost no vibration, so we don't lose stability) and the implant (no thermal effect).

Of course, we can also use the Er:YAG laser for more common and "easy" procedures—like implant uncovering (Er:YAG). The healing is faster and we avoid suturing, but of course, even with the thin chisel tip, some amount of soft tissue is vapourised—so it cannot be conducted in all cases.

In 2018, you defended your master's thesis at RWTH Aachen University titled *Comparison of Two Methods of Periimplantitis Treatment with the Use of Nd:YAG and Er:YAG Laser*. Can you tell us more about that research?
Owing to the increasing number of implants being placed, the development of peri-implantitis is a growing concern and one of the primary challenges in present-day dentistry. In cases of inflammation, it is necessary to implement treatment, or risk implant loss. However, until now, no uniform protocol or procedure has been defined which could be considered the best and the most effective solution. Different methods of treatment of tissue inflammation around the implant are used, depending on the extent of inflammation, method availability, type of defect, and skills and experience of the dental surgeon.

We know that laser can be used for the treatment of inflammation in soft and hard tissue around implants, such as mucositis and peri-implantitis. I wanted to investigate what kind of procedure would be the most effective and minimally invasive—so the question was whether we could use a minimally invasive, flapless procedure for proper treatment and solve the problem of inflammation.

> "I really appreciate the deep disinfection with Nd:YAG, which offers the highest bacterial reduction [...]"

The procedures were conducted with Er:YAG and Nd:YAG lasers. In the first group of patients, a mucoperiosteal flap was elevated in order to gain better access to the operative area, while the second group of patients was treated using a more minimally invasive procedure without the flap method. The assessment of treatment effectiveness involved clinical and radiographic examination before the surgical procedures and three months after the laser procedures. After conducting the intra-oral examination and defining plaque, probing depth and bleeding on probing indices, photographic documentation of a given area was performed, bitewing and occlusal surface radiographs were taken, and professional scaling and root planing were subsequently carried out.

Based on my research, we know that non-surgical treatment of peri-implantitis is effective and very often reduces inflammation. Of course, when we have severe defects, it's impossible to avoid a surgical procedure to elevate a flap to get proper access to the defect. In such cases too, we should use a non-surgical procedure as a first step to decrease the inflammation and, after two to three weeks, perform the flap procedure.

Can you describe your standard laser protocol for peri-implantitis treatment?
Firstly, we have to distinguish mucositis from peri-implantitis with a radiovisiograph and with the use of a periodontal probe. If possible, I remove the prosthetic restoration to get better access for the treatment. In our surgical protocol, we have five steps: (1) removal of granulation tissue with the use of the Er:YAG laser (cylindrical tip); (2) decontamination

Fig. 1: Initial situation. **Fig. 2:** Pocket depth measurements. **Fig. 3:** Bleeding on probing. **Figs. 4 & 5:** Use of the Er:YAG laser Varian tip for granulation tissue removal, implant surface decontamination and surface ablation of infected bone. **Fig. 6:** Photo-biomodulation with the Nd:YAG laser. **Fig. 7:** Final results after three months. No sign of inflammation.

of the implant surface with Er:YAG; (3) surface ablation of infected bone with Er:YAG; (4) reduction of bacteria in the bone with the Nd:YAG laser; and (5) photo-biomodulation with the Nd:YAG laser (after flap closure).

In our non-surgical procedure, there are only four steps—I skip deep disinfection with the Nd:YAG laser owing to the 1,064 nm wavelength's high absorption in titanium (it's not possible without elevating a flap to disinfect only the bone and not harm the implant surface). As I mentioned, the flapless procedure is most often my first option, and when the defect is severe, I decide on a surgical procedure as the second stage.

After the procedure, the same restoration is generally placed in the mouth (after corrections if necessary). Sometimes, depending on the type of bone defect, I decide to conduct bone regeneration with the use of bone substitute and collagen membranes. In such cases, I have to remove the restoration and, after peri-implantitis treatment with the use of laser and bone augmentation, close the flap with cover screws, leaving the patient with no restoration (posteriorly), not even a temporary one, for two to three months.

What are the benefits of LightWalker for the treatment of peri-implantitis in your everyday practice?

As I mentioned, the treatment of peri-implantitis is a huge challenge nowadays; statistically, in 20% of cases peri-implantitis develops and in 40% of cases mucositis develops around inserted implants. Treatment with the use of Er:YAG and Nd:YAG lasers is very effective, fast and comfortable

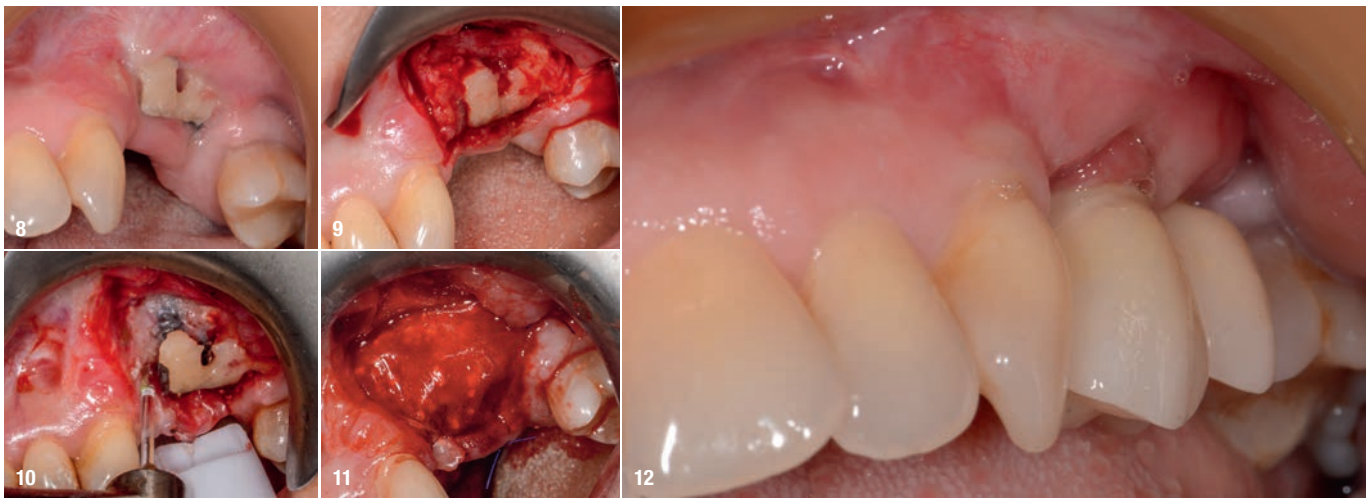


Fig. 8: Initial situation. **Fig. 9:** Granulation tissue visible after flap elevation. **Fig. 10:** Granulation tissue removal with Er:YAG laser. **Fig. 11:** Bone augmentation. **Fig. 12:** Final results with restoration two years post-op.

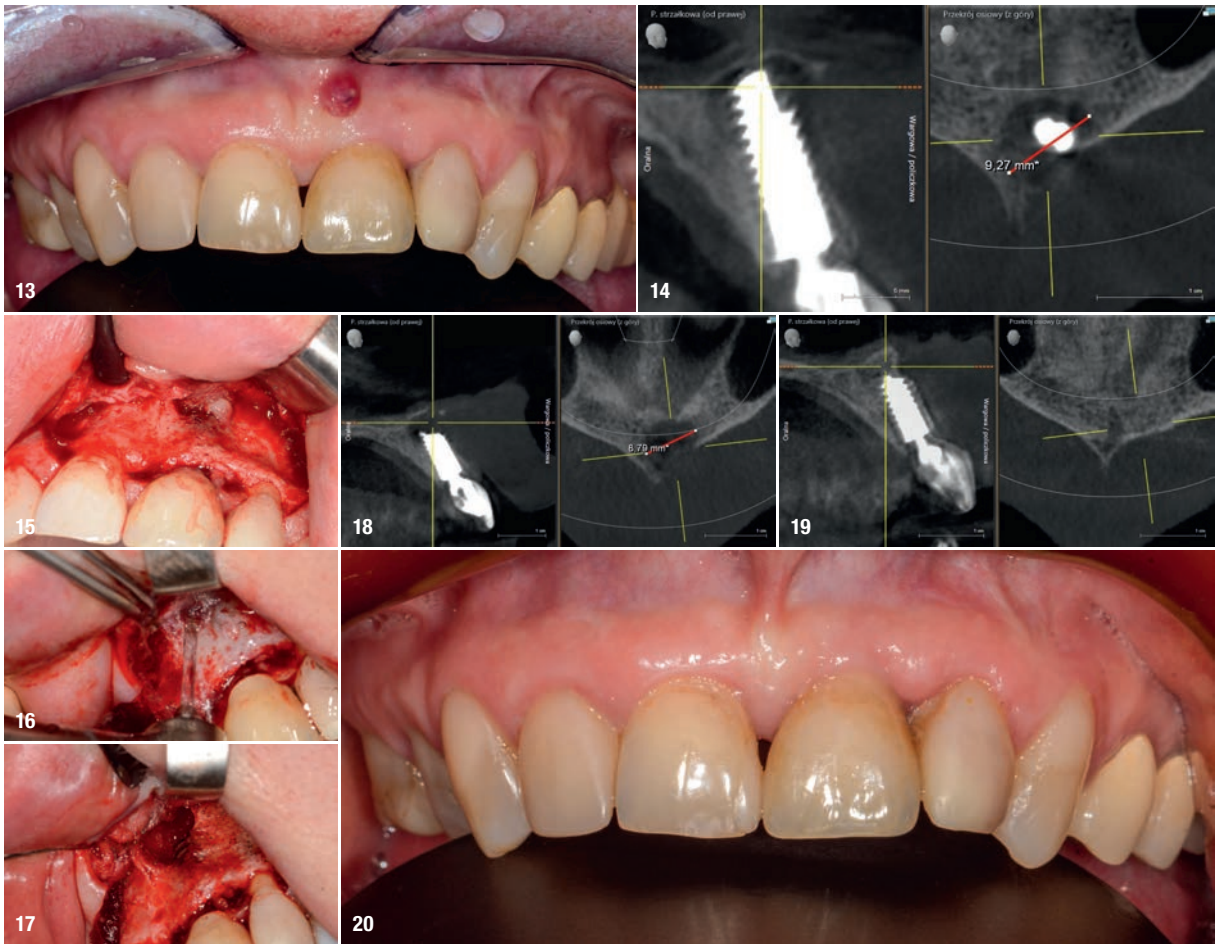


Fig. 13: Initial situation. Visible fistula one year after loading. **Fig. 14:** Bone defect of 9.27 mm in diameter. **Fig. 15:** Flap elevation. **Fig. 16:** Granulation tissue removal with Er:YAG. **Fig. 17:** Implant resection. **Fig. 18:** CBCT scan on the day of surgery. No bone augmentation. **Fig. 19:** CBCT scan 1.5 years post-op. Visible bone regeneration. **Fig. 20:** Situation 1.5 years post-op. No sign of inflammation.

for both patients and practitioners. We can use a minimally invasive, non-surgical treatment, which very often is highly effective, and thus avoid a surgical procedure. However, it's very important that we use our lasers with proper parameters to protect the soft and hard tissue and not alter the implant surface. We can thoroughly remove bacterial biofilm from the implant surface without altering it, and we have the possibility of re-osseointegration. Of course, we have to be aware of risk factors and aim to avoid them, understand what the reason for the disease was and solve the underlying problem. Sometimes, it's only improper oral hygiene, while other times, we must change or correct the restoration. Each case is individually treated.

Could you share with us some of your more challenging cases of peri-implantitis and explain how the treatment was performed?

Case 1 was a patient who presented with deep pockets (9 mm), bleeding on probing and visible purulent effusion (Figs. 1–7) and was treated with a non-surgical protocol. In Case 2, the patient preferred a surgical procedure with bone augmentation, as a consequence of bone graft complication and graft exposure (Figs. 8–12).

The implant apicectomy in Case 3 shows that one year after the immediate implantation with immediate loading there was inflammation around the implant apex. The rest was properly integrated (Figs. 13–20).

What advice would you give to your dental colleagues who may be considering whether to incorporate laser technology into their practice?

I can only advise them to use laser; there is no reason to hesitate. Laser technology really changes dental practice. Laser use provides new possibilities, new treatment protocols and many advantages in dental procedures. Our treatments are more comfortable, less painful (sometimes even painless) and very often less invasive and more predictable. We have a great advantage of selective tissue removal based on the chosen laser wavelength and settings. Last but not least, it is better for our marketing, and patients now expect newer technologies.

Editorial note: A shortened version of this interview was published in implants—international magazine of oral implantology*, vol. 23, issue 1/2022.*

Restorative aesthetics at the gingiva

Drs George Freedman & Paiman Lalla, Canada & Trinidad and Tobago

Fig. 1: Normal-length maxillary central incisors—expected appearance. **Fig. 2:** Maxillary incisors with apparent length increased by 30%—very unnatural and unaesthetic.

Aesthetic dilemma of the gingival margin

The data is clear: porcelain and composite resin are both biocompatible at the gingival margin and well tolerated.[1–3] The caveat is that composite tends to cause tissue irritation if it directly impinges on the gingiva.[4–6] This ultimately causes unesthetic gingival recession. Porcelain is less problematic, but marginal plaque build-up, initiated by the thin layer of resin cement, leads to a similar irritation of the free gingiva and eventually recession.[7,8]

Even skilful subgingival margin placement will typically, within three to five years, because of ageing, gingival irritation or lack of home maintenance on the patient's part, lead to unesthetic recession and full visible exposure of the darker dentinal tissue.[9,10] Thus, the restorative conclusion is location of the composite margins supragingivally,[3,11] placing the resin material a reasonable distance (0.25–0.50 mm) from soft periodontal structures and thereby unlikely to cause tissue irritation.

Fig. 3: Beautifil II Gingiva shades. *(Image: © SHOFU)*

Today's adhesives and restorative materials make this a rather straightforward task.[12–19] Newer-generation adhesives bond equally well, and predictably, to both enamel and dentine.[14,15] Significantly, seventh- and eighth-generation adhesives have similar bonding strengths to both enamel and dentine, eliminating the potential stresses caused by unequal polymerisation contraction.[17–19] It is clinically possible to create a continuous restoration through the dentino-enamel junction (DEJ), covering as much of the enamel and the dentine as necessitated by caries or abfraction (or both).

A significant aesthetic predicament quickly presents, however. Dental restorative materials are designed to match the shade of the enamel position of the tooth. Although some manufacturers offer dentine shades, these hues typically do not closely match the darker coloration of exposed dentine, particularly those observed in endodontically treated teeth. A typical central incisor measures approximately 10.5 mm cervico-incisally.[20] A substantial increase in the apparent length of a tooth, specifically in the anterior labial region, detracts from the aesthetic smile.

When restoring a tooth with Class V caries or abfraction, or perhaps a small gingival recession, an enamel-coloured resin is commonly placed at the labial DEJ. Increasing the maxillary central incisor's vertical aspect (Fig. 1) by a mere 3 mm adds 30% to the apparent vertical dimension, significantly altering the cervico-incisal–mesiodistal ratio, totally upsetting the aesthetic parameters of the smile (Fig. 2).

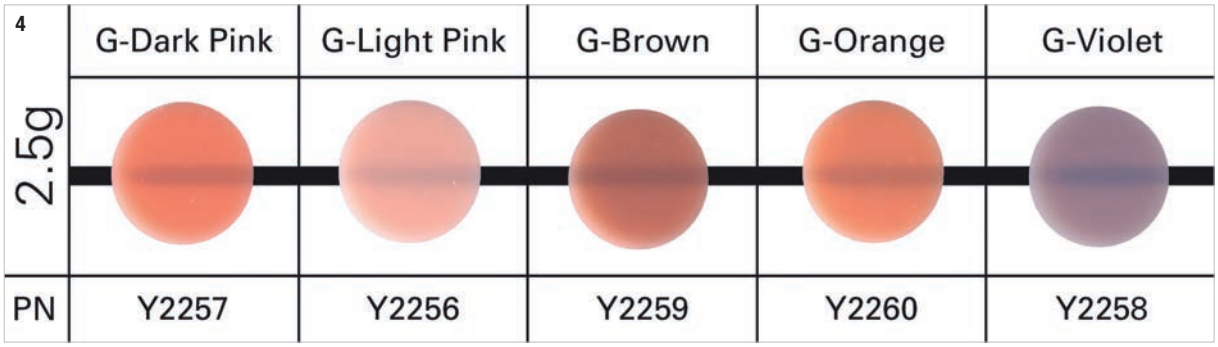


Fig. 4: The five shades of Beautifil II Gingiva. *(Image: © SHOFU)*

In situations where there is moderate recession, the visual imbalance is even further impaired. The impact of the cervico-incisal–mesiodistal ratio is even greater on maxillary lateral incisors and mandibular incisors (average of 9 mm cervico-incisally). Maxillary and mandibular canines (average of 10–11 mm cervico-incisally) are often the teeth most affected by gingival recession and are highly visible, both anteriorly and laterally.

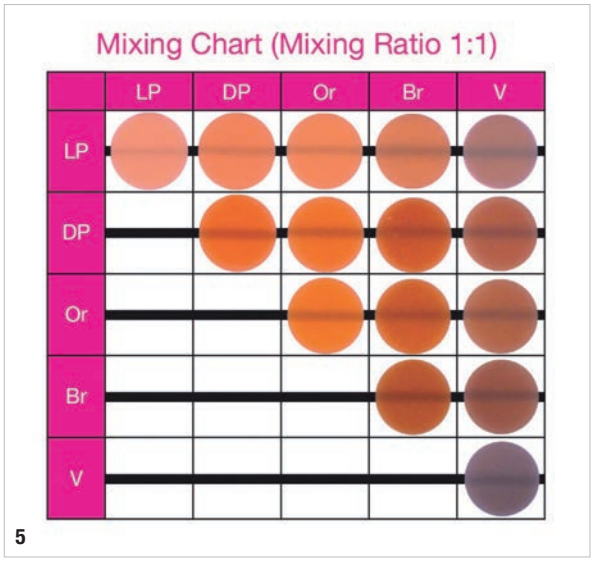
Individuals who have gingival recession, abfraction and/or caries tend to look older than they really are (long in the tooth). Covering the darker root dentine with an enamel-like resin simply makes their teeth more visible, seemingly longer, and correspondingly less aesthetic.

The practitioner must solve this problem practically, aesthetically and with minimum invasiveness. The restoration must be functional, replacing missing dental structures to natural dimensions and contours. The restoration should replace lost enamel with enamel-shaded composite resin and receded gingiva with gingiva-shaded composite resin. By creating an artificial enamel–gingiva junction in composite restorative material, the patient's aesthetics and smile can be restored.

Solving the gingival aesthetic dilemma

Beautifil II Gingiva (SHOFU) has been specifically designed for the rebalancing of pink aesthetics in the cervical areas of the dentition (Fig. 3). It is indicated for wedge-shaped defects, cervical caries, the aesthetic rectification of gingival recession, shielding exposed cervical areas and splinting of mobile teeth. The resin material is available in five tones (Dark Pink, Light Pink, Brown, Orange and Violet; Fig. 4), which can be layered and/or blended to achieve custom shades that allow the treatment of patients with various hues of gingival pigmentation, according to their clinical needs (Fig. 5).

Beautifil II is a highly aesthetic, fluoride-releasing composite resin material indicated for all classes of restorations. Numerous studies over the past 20 years have shown no secondary caries, no failures, no postoperative sensitivity and a high retention of both shade matching and surface lustre. The material is based on SHOFU's proprietary giomer technology. The significant advantage of the giomer class of resins is not only that they release fluoride to protect the tooth at the restorative margin, but that their fluoride content can be recharged by toothpastes, fluoride rinses and varnishes (Fig. 6). Thus, a giomer's fluoride-releasing capacity does not decrease over time.



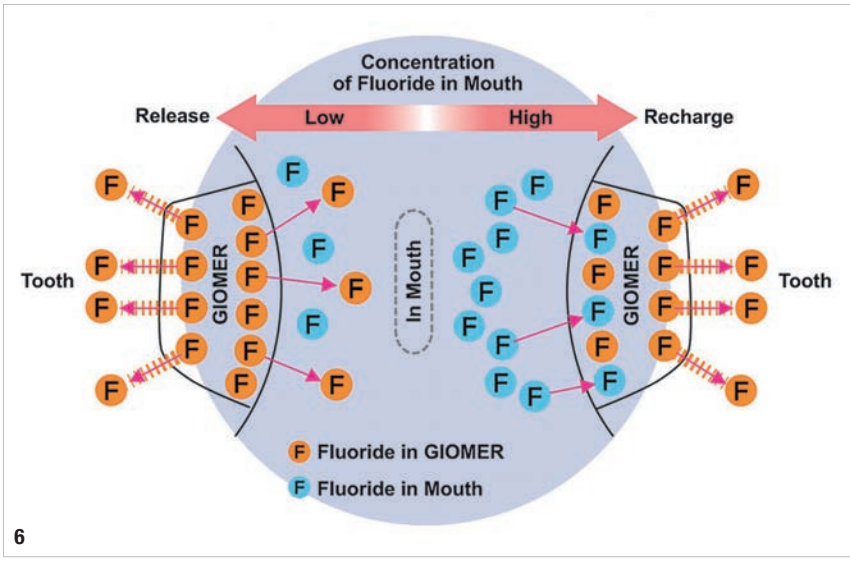


Fig. 5: Mixing chart showing the resins layered and/or blended to achieve custom gingival shades (1:1 mixing ratio). *(Image: © SHOFU)* **Fig. 6:** Fluoride release and recharge from giomers.

Fig. 7: Maxillary left lateral incisor with caries and recession *(photograph taken using the EyeSpecial, SHOFU).* **Fig. 8:** BeautiBond seventh-generation dental adhesive. *(Image: © SHOFU)* **Fig. 9:** Maxillary left lateral incisor with mesial restoration and gingival restorative rectification *(photograph taken using the EyeSpecial, SHOFU).*

Another important consideration is that the gingival margin of the restorative material (whether pink or enamel in colour) must be kept supragingival and slightly away from the free gingival margin.[3,4,6] Although a very narrow band of darker root structure may be visible towards the apex, the restoration's enamel (coronal) and pink gingival (radicular) coloration will focus attention away from this area. With gingivally blended restorations, the dental professional can deliver both aesthetic and supragingival margins within the same restoration. A supragingival margin facilitates ready access and effective home maintenance for the patient.

It is imperative that a restoration that is so close to the free gingival margin be placed under conditions controlling moisture and bleeding. Dental dam placement is impractical (the target area is positioned apically), and retraction cord may physically or chemically compromise the working area. Ideally, the patient's oral hygiene would have created a healthy gingival microenvironment with minimal pocketing and no bleeding on probing. In most cases, however, the practitioner must modify the actual situation to increase the likelihood of clinical success. The easiest and best technique for predictable tissue sculpting is the use of the diode laser.[21–23] Utilising low power (1.0–1.5 W), the dentist can produce an ideal —dry, clean and blood-free —working area in less than a minute.

Clinical cases

Visible recession and caries

Remarkably, the patient's chief concern was the gingival recession on the maxillary left lateral incisor, not the mesial caries (Fig. 7). Fortunately, the patient's oral hygiene was relatively good, and restoring the MLB caries was straightforward using BeautiBond (SHOFU; Fig. 8) and Beautifil Flow Plus X. The steps for the aesthetic rectification of the buccal recession are as follows:

1. Gently micro-abrade the receded area and the apical enamel to remove food debris and plaque. The nozzle of the abrader should be angled incisally to prevent gingival irritation and bleeding. Rinse thoroughly and lightly air-dry, leaving the surface slightly moist (although the degree of moistness is not critical).
2. Apply BeautiBond, a seventh-generation dental adhesive, and leave on for 10 seconds. Thoroughly air-dry the adhesive (very critical). Light-polymerise with the FUSION 5 curing light (DentLight), offering deep polymerisation of composite resins within 3 seconds with a uniform 4,000 mW/cm^2 output.
3. Select the appropriate Beautifil II Gingiva shade (Light Pink and Violet for this patient), apply to the receded area to restore the buccal dimension and contour of the original soft tissue, and light-polymerise. It is important to leave a small (0.25–0.50 mm) gap between the apical margin of the

Fig. 10: Mandibular anterior teeth with labial gingival recession. **Fig. 11:** Mandibular anterior teeth close-up. *(Photographs taken using the EyeSpecial, SHOFU).*

restoration and the free gingival margin (Fig. 9). This space prevents gingival irritation, is easily maintainable by the patient and is generally not visible even with close-up photographs.

Mandibular anterior recession

This is the most commonly encountered recession in the oral cavity. The mandibular anterior teeth are small, close together and not effectively cleaned at the tongue and the lower lip (Fig. 10). Owing to gravity, food debris and plaque tend to accumulate labially and interproximally (Fig. 11). In this case, the major culprit of the recession was the frenum pulling the attached gingiva apically. The preliminary process is a diode laser frenectomy to eliminate the muscular forces.[21–23] The steps for the aesthetic rectification of the buccal recession are as follows:

1. Gently micro-abrade, in an incisal direction, the receded areas and the enamel nearest to the DEJ to remove food debris and plaque. Rinse thoroughly and lightly air-dry, leaving the surface slightly moist.
2. Apply BeautiBond and leave on for 10 seconds. Thoroughly air-dry the adhesive and light-polymerise.
3. Select the appropriate Beautifil II Gingiva shade (Light Pink in this case), apply to the receded area to restore the buccal dimension and contour of the original soft tissue, and light-polymerise. Leave a small (0.25–0.50 mm) gap between the apical margin of the restoration and the free gingival margin (Fig. 12). This procedure restores the expected gingival height and contributes to making the patient's smile look younger.

Long-term at-home maintenance is best accomplished with procedures that are familiar to the patient and easy to implement. Regular toothbrushing is effective and practised by most dental patients, interdental string flossing less so. Though the advantages of flossing are well established, patient resistance to the process and irregular application limit its benefits. Water flossing (Waterpik) not only facilitates the interdental cleaning process, but has been shown to improve the results.[24] There are several models available, but the Sonic-Fusion offers simultaneous water flossing and sonic toothbrushing.

Conclusion

Beautifil II Gingiva enables the practitioner to overcome the gingival aesthetic dilemma. The gingival rectification technique is predictable and can typically be accomplished without the need for local anaesthetic and without discomfort to the patient. These restorations are completely functional and replace both hard and soft missing dental structures to natural dimensions and contours with minimum invasiveness. The restoration of the coronal anatomy with tooth-coloured composite resins is well established. The development of an artificial enamel–gingiva junction and the reconfiguration of missing gingival structures with composite resins is a novel solution that restores the patient's smile and facial aesthetics.

Fig. 12: Mandibular anterior teeth with gingival restorative rectification *(photograph taken using the EyeSpecial, SHOFU).*

about

Dr George Freedman maintains a private practice in Toronto in Canada limited to aesthetic dentistry. He is adjunct professor of dental medicine at Western University of Health Sciences in Pomona in California in the US and a visiting professor and director of the MClinDent programme in restorative and cosmetic dentistry at BPP University in London in the UK.

He is the author or co-author of 14 textbooks, and of more than 800 dental articles and numerous webinars. He serves on the editorial team of *REALITY* and is the international editor-in-chief of *3D printing—international magazine of dental printing technology*. Dr Freedman is a regent and fellow of the International Academy for Dental-Facial Esthetics and a diplomate and chair of the American Board of Aesthetic Dentistry. He is a founder and past president of the American Academy of Cosmetic Dentistry and a founder of the Canadian Academy for Esthetic Dentistry and the International Academy for Dental-Facial Esthetics. Dr Freedman is a recipient of the Smigel Prize in Aesthetic Dentistry (New York University College of Dentistry).

Dr Paiman Lalla, a graduate of the University of the West Indies, practises dentistry in Trinidad and Tobago and has a special focus on cosmetic and implant dentistry. After completing the Advanced Education in General Dentistry program at Lutheran Medical Center in Wheat Ridge in Colorado in the US, he was awarded fellowships in the International Congress of Oral Implantologists and the American Academy of Implant Prosthodontics. Dr Lalla serves on the medical panel of Trinidad and Tobago's ministry of national security.

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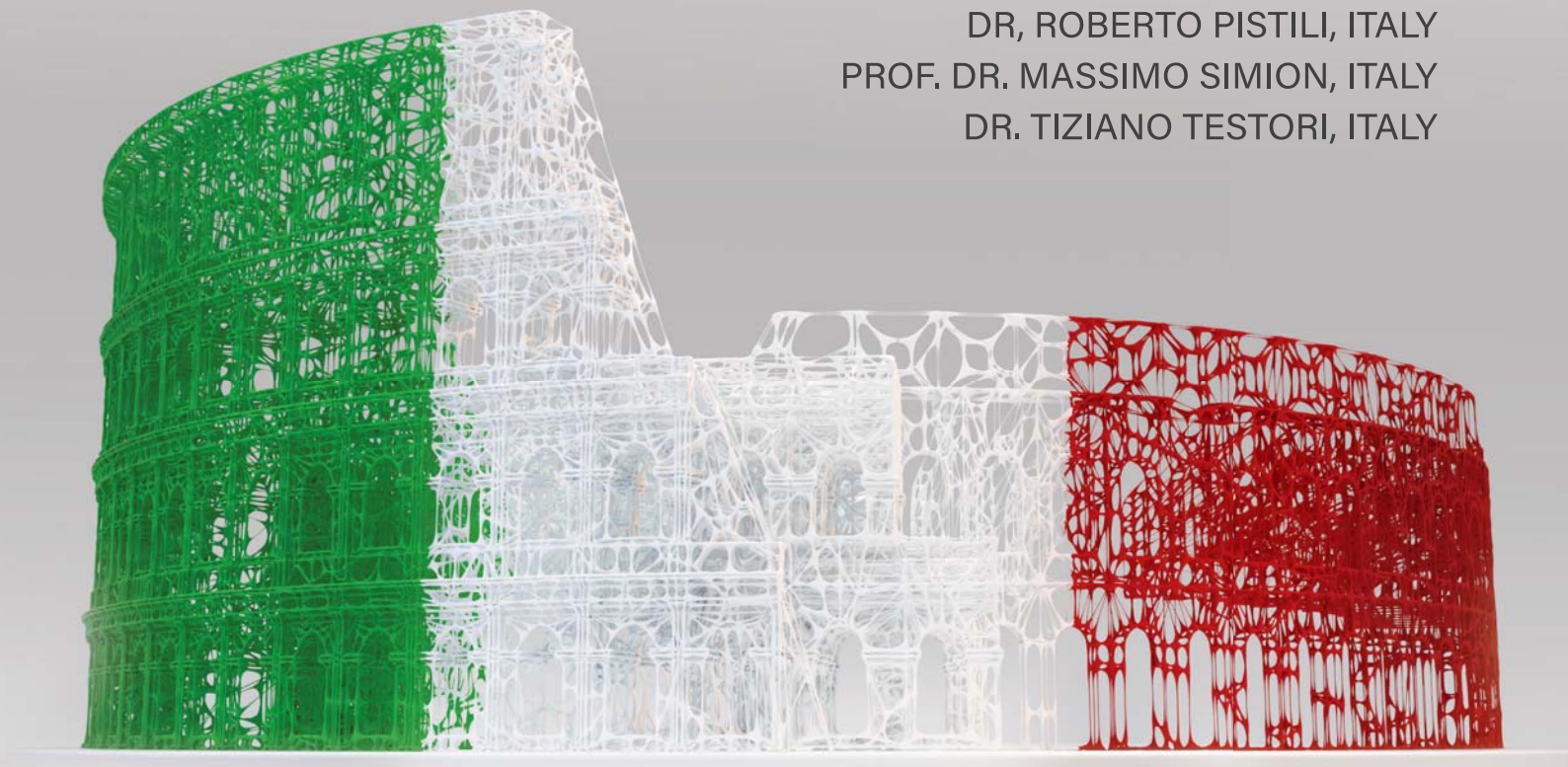

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Holbeinstr. 29, 04229 Leipzig, Germany
Tel.: +49 341 48474-302
Fax: +49 341 48474-173
General requests: *info@dental-tribune.com*
Sales requests: *mediasales@dental-tribune.com*
www.dental-tribune.com

Official publication of:

Printed by
Löhnert Druck
Handelsstraße 12
04420 Markranstädt, Germany

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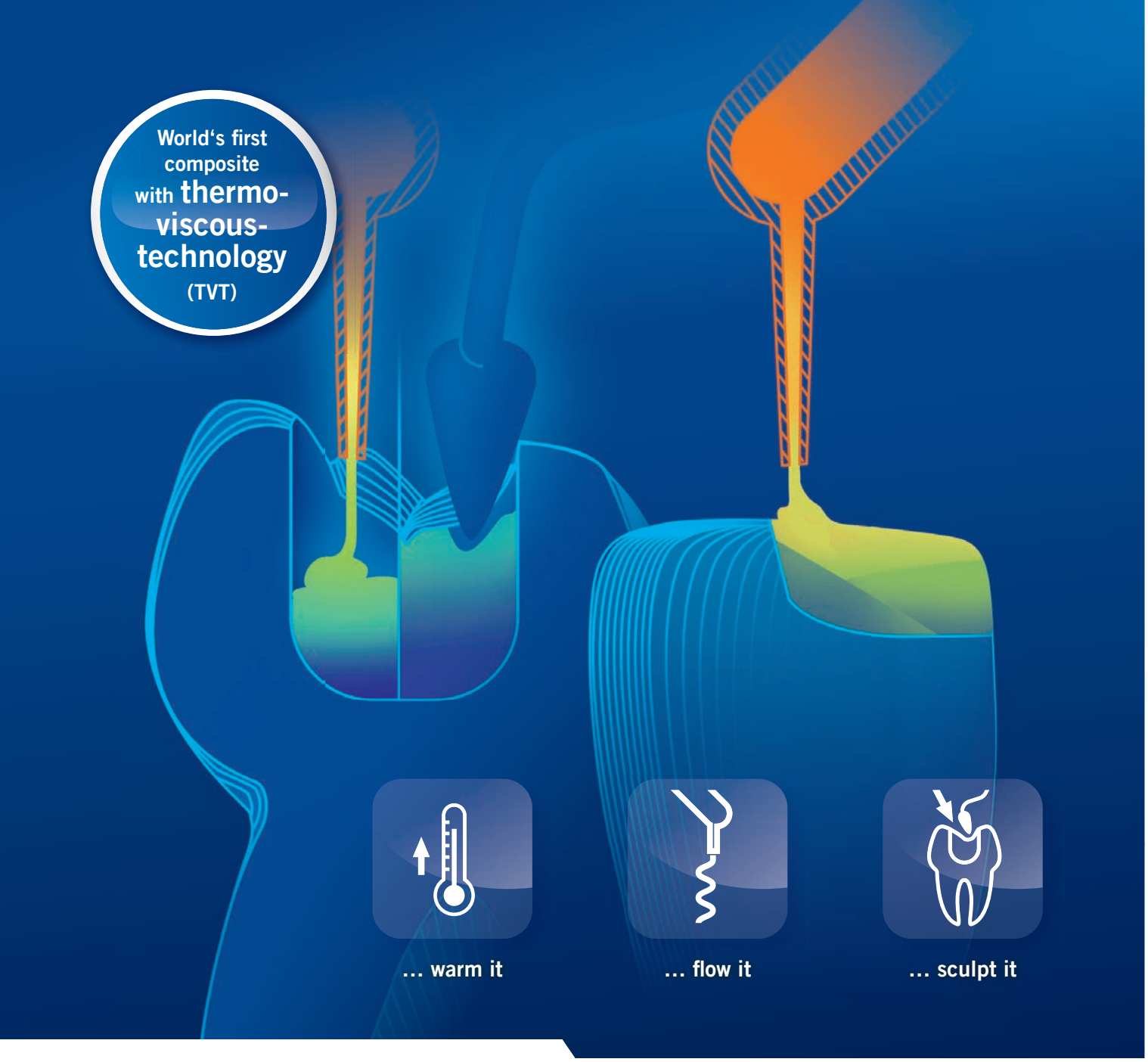

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