GC get connected 16

Your product and innovation update

2020

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Contents

Dear readers

Welcome to the 16th edition of GC's Get Connected newsletter.

Every time a patient steps into your practice, a diagnosis and treatment plan have to be made and the appropriate instruments and materials selected. The cases and interview in this edition of 'GC get connected' show you that there are various paths to achieving excellence: The hands, eyes and experience of the clinician are decisive for the long-term treatment success. But for the latter refined materials and the knowledge of some application details remain required as well. In this edition, you'll find an argument why we recommend G-Multi PRIMER with a stable silane inside to achieve excellent marginal quality with glass ceramic veneers. You'll find two completely different ways to find the right shade in a very easy predictable way, one based on artificial intelligence, the other based on a single shade technique to equally support the dental technician and the clinician. We'd like to inspire you with the unique advantages of fibres in our everX composites, where we experience a strong demand especially for heavily destroyed teeth still treated in a direct workflow.

No matter what your focus is, we are confident that you'll find exciting new things within the pages of this magazine !

André Rumphorst

General Manager Marketing & Product Management
GC Europe NV

Aesthetic rehabilitation with leucite-reinforced glass ceramics

Dr. Sidimohamed Bechiri *graduated from the Dental Faculty of Algiers University of Medicine (Algeria) in 2012. Then, he started practicing in a multidisciplinary private dental clinic in Algiers. He mainly focuses on adhesive dentistry and in-office CAD/CAM restorations.*

By **Dr. Sidimohamed Bechiri**, Algeria

Ceramic veneers have become popular aesthetic treatment options that balance minimal invasiveness and durability in an optimal manner. Pure feldspathic porcelain exhibits the best aesthetical appearance, but is brittle in nature and lacks in strength. Therefore, these are usually reinforced by dispersing a phase of a different material, such as leucite. These included nuclei strengthen the material and are able to stop crack propagation. Additionally, the restoration needs to be of sufficient thickness and a good bond to the underlying substructure, preferably enamel, is essential to reinforce the restorative complex.

The following case report illustrates the aesthetic potential of leucite-reinforced glass ceramics.

A 29-year-old female patient sought treatment because she was dissatisfied with the appearance of her smile. Previously, she had undergone orthodontic treatment without a satisfactory result. She had large direct composite restorations on the upper incisors, which had been repeatedly replaced and repaired. On the first premolars, she had crowns that were lighter in shade than the surrounding dentition (Fig. 1).

In consultation with the patient, it was decided to bleach the teeth to obtain a better match with the crowns and to restore the maxillary incisors with leucite-reinforced glass ceramic veneers (Initial LRF, GC) for a durable end result.

All teeth were vital; hence, they were bleached externally. After 3 in office bleaching sessions with hydrogen peroxide (37%), a satisfactory result was obtained and the restoration shade was determined.

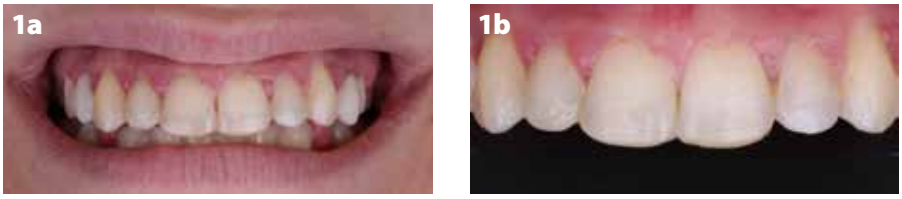

Fig. 1: (a) Smile before treatment. **(b)** Intraoral view of maxillary anterior teeth.

Before taking a digital impression (Fig. 2), a gingival correction with laser was done and the teeth were prepared in accordance with the requirements for the restorative material: all internal edges were rounded and it was ensured that there was sufficient space to have a material thickness of at least 0.6 mm in all areas. The entire preparation was exclusively in the enamel (Fig. 3); this ensures optimal bonding conditions and strengthening of the restorative complex.

Thereafter, the veneers were digitally designed (Fig. 4) and milled from Initial LRF Block, shade A2. The restorations were subtly stained in the cervical and incisal areas and then glazed (Fig. 5).

In more complex cases where the restoration shape and shade will need more planning and evaluation, a digital wax-up and printed mock-up could be created before tooth preparation for a more thorough evaluation; however, in this case, it was not strictly necessary. Temporary restorations were made with self-curing resing using the silicone impression taken before preparation.

Two days later, the veneers were cemented. For cementation, the G-CEM LinkForce (GC) system was used. This system consists of a restoration primer, a universal adhesive and a dual-cure resin cement. After removing the temporary restorations and cleaning the teeth, the fit, shade and occlusion of the veneers were first tried with G-CEM Try-In Paste, which is part of the G-CEM LinkForce system.

Fig. 2: Digital impression of the initial situation.

Fig. 3: After gingival laser correction and preparation of the 4 incisors.

Fig. 4: Digital design of the veneers on the maxillary incisors.

Fig. 5: Initial LRF veneers after staining and glazing.

Fig. 6: Etching with hydrofluoric acid (9%) during 60s.

Fig. 7: Cleaning with phosphoric acid (37%) to remove remaining precipitates.

Based on the try-in, shade A2 was selected. The veneers were thoroughly rinsed (the try-in paste can be easily removed with water) and etched with hydrofluoric acid (9%) for 60 seconds (Fig. 6). After this step, crystalline precipitates remain on the surface. To remove those, the surface was cleaned with phosphoric acid (37%) (Fig. 7).

Fig. 8: Rubber dam isolation.

Fig. 9: G-CEM LinkForce system.

G-Multi PRIMER was used for the pretreatment of the leucite-reinforced glass ceramic restorations; it was applied to the intaglio surface and dried carefully with oil-free air. Unlike 'universal adhesives' that are used to bond to tooth tissue as well, G-Multi PRIMER contains no acidic primers. Hence, the stability of the silane present in G-Multi PRIMER is not compromised.[1] To ensure good bonding with tooth tissue, G-Premio BOND was applied onto the prepared enamel and light-cured in accordance with manufacturer's instructions. G-CEM LinkForce (Shade A2) was placed onto the primed surface of the restoration and seated. Under rubber dam isolation (Fig. 8), the cementation was started from the midline towards lateral. Hence, the two central incisors were cemented first (Fig. 9).

After careful seating, excess was removed and the cement was light-cured (Fig. 10).

Thereafter, the two lateral veneers were cemented. After having removed all cement residues, the margins were polished (Fig. 11).

Fig. 10: Light-curing of the cement.

Fig. 11: Immediately after cementation.

The patient was very satisfied with the treatment. In Figures 12 and 13 the final result immediately after treatment and after 6 weeks are shown, respectively.

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Fig. 12 (a-c): Final result.

Fig. 13: (a) Smile after 6 weeks. **(b)** Intraoral view of maxillary anterior teeth.

Achieving a single central shade match at the first attempt

By **Marat Awdaljan**, the Netherlands

Marat Awdaljan *is a dental ceramist, born in 1988 in Tbilisi (Georgia) to Armenian parents. In 1993, his family moved to the Netherlands, where he grew up.*
In 2013, he founded a project for which he travels the world to meet the Masters in Dentistry in order to find answers to all the questions and problems in the dental field. Interviews with these Masters have been published in Labline Magazine. Combining the knowledge from this journey with the extended research he is currently focusing on, Marat has created and developed "MATISSE", The Universal Shade Matching Software for dentists and dental technicians and he gives lectures and courses worldwide.

matisse®

marat@labmatisse.com
www.labmatisse.com

The patient's tooth #11 was fractured during an accident. After correcting it temporarily with composites, the dentist decided to solve the problem with a partial crown. The reason was that the tooth had begun to change colour; it was becoming darker and the patient wanted to have the same colour as tooth #21 (Fig. 1).

Fig. 1: Intraoral view, showing the discoloured preparation

In this article, it is demonstrated how easy and predictable a single central shade match can be done with GC Initial LiSi. Matisse Software plays an important role in this process (Fig. 2). Matisse is embedded with artificial intelligence technology to generate precise colour solutions, including which dentin powders to choose and mix and which substructure to use. After applying the recipes, the dental technician will be able to achieve a correct shade match.

Fig. 2: Matisse, Shade Matching Software

The preparation for the case:

The patient visits the dental laboratory or the dentist's office for the dental photos and the shade taking. To receive precise recipes, three dental images are necessary (Fig. 2):

1: Initial situation with crossed polarization filter.
2: Initial situation without filters.
3: Photo of the preparation with crossed polarization filter.

Steps in Matisse software:

Dental photos

After importing the images to the software we select the gray card setting, in this case L*79 is selected (Fig. 2). Matisse is also compatible with Vita 3D Master shade guide in combination with the Whibal card (L*76).

When clicking on the "Calibrate Photo" button, we choose a spot on the grey card and the photo will be automatically calibrated (Fig. 2).

Ceramic brands

In this case, GC Initial LiSi was chosen.

Indications

Crown is selected as case indication. There are other options: Veneer on refractory, implant crown, Maryland bridge, full monolithic crown and veneer on lithium disilicate (Fig. 2).

Substructure

In this case, we chose a substructure with high opacity to mask the preparation and at the same time to

have enough brightness, to be able to achieve the same value (Fig. 3).

Total available space

The space from the preparation to the final thickness of the crown is measured; this is very easy when the crown has been digitally designed (Fig. 2).

Layering of the crown:

First, the substructure is stained on the cervical area with Initial Spectrum Stains SPS-2 and incisal area with Initial Spectrum Stains SPS-2 and SPS-13, powdered with FD-91 and washfired (Fig. 4).

The histo-anatomy of the tooth is analysed and a shade map is created. The recipes are mixed with a universal portioner or the smile line portioner.

Layer 1: Histo-anatomy of dentine

To create a natural looking transition from dentine to enamel with opalescence, it is advised to start with an enamel canvas (Fig. 5). The enamel canvas that is used comes from the enamel indication E-59 from Matisse software.

The internal characterisation recipe (Fig. 3) is layered on top of the enamel with the exact histo-anatomy of the incisal dentine (Fig. 6). The best way to understand the dentine anatomy is to play with the light in an image of the workpiece; it is advised to use a photo editing program and to increase the clarity and dehaze the image.

The dentine from the cervical to the middle area is layered first (Fig. 7) and

Fig. 3: The ceramic powder recipes

Fig. 4: The advised calculated substructure

Fig. 5: Enamel canvas with E-59

Fig. 6: Internal characterisation recipe is applied as dentin on the incisal area

Fig. 7: Cervical dentin recipe is applied

the recipe of the middle area is used immediately after that (Fig. 3).

When layering the middle area of the tooth, it is important to focus on the precise volume (Fig. 8). To achieve the same level of opacity and brightness, it is important to decrease the thickness of enamel/transparent ceramics and increase the thickness of dentine.

Fig. 8: Dentin recipe middle is applied

Fig. 9: Internal effects are applied including EOP-Booster, TM-02, EOP-2 and CT-23

Fig. 10: Try- in after the first bake

Fig. 11: Final result on the model

Fig. 12: Final result in the mouth

Fig. 13: Close up of the final result

Layer 2: Internal effects

Incisal area
To create a higher level of optical integration, it is important to layer a thin layer of opalescent material from the incisal third, in this case EOP-Booster. Then, the mamelons are created with IN-41. On top of the mamelons a thin layer of CT-23 is used to create the incisal warmth. For the line angles, EOP-3 is used to create a blueish appearance (Fig. 9).

Middle area

EOP-2 and TM-02 were used to create the bright areas in the middle of the tooth.

Cervical area

CT-23 shade was added to the cervical area to create a smooth transition to the gingiva.

Try-in after the first firing

The result after the first bake is very accurate, no colour adjustments are needed. Now we can apply the skin enamel and finish the case. Most cases are done in two firings with very predictable results (Fig. 10)

Layer 3: Skin enamel

Every case needs a different approach to choosing skin enamel. There are situations where one type of enamel is enough, in other cases each section needs a different type of enamel, and in very few cases a very thin layer of transparent layer is needed on top of the enamel to create an identical match and a better optical integration.

In this case, pure enamel E-58 was used on the middle area and a mixture of E-59/EOP-Booster and CL-F mixed in the same portions on the other areas. It is advised to always finish the second bake with a Halo effect, in this case IN-41 was used. Very small adjustments, like brown and white spots are made with the glaze firing (Fig. 11).

Final result

The final result of the try- in in the laboratory is shown in Figures 12-14. To check objectively if the histo-anatomy

Fig. 14: Crossed polarization picture of the final result

Fig. 15: Edited picture to see the internal effects

Fig. 16: Value check of the final result

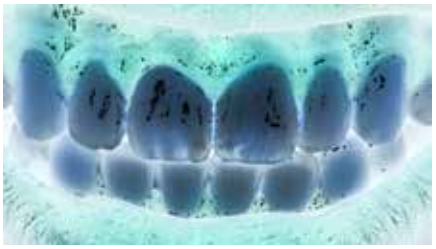

Fig. 17: The ultimate check of the final result with negative inversion

of the crown is created correctly, it is recommended to import the picture in Adobe Photoshop and play again with the light. Clarity and dehaze of the photo are increased to check the colour intensity (Fig. 15). The greyscale function was used to check the value (Fig. 16). The ultimate test is to invert the image colours (negative) (Fig. 17). In an inverted image, the transition from opacity to transparency is clearly visible. It is advised to do this in every case in order to observe the mistakes and understand what to improve for the next case.

Conclusion

The ideal for every dental technician is to mimic nature, to create a restoration with ceramics that is hard to distinguish from the natural tooth. Usually, this takes many colour corrections, time-consuming remakes and frustration, and still the goal may never be reached. Now, with the Matisse software, this challenging case had an excellent shade match at the first attempt. The final result is predictable, precise and achieved with the usual process of layering. Matisse makes the dreams of a dental technician come true in less time and effort.

Acknowledgement:

This case was executed during a 'Single central Live patient' Matisse course. The author would like to thank MSc. M. de Beer for the clinical work.

Shape matters: conservative alterations of tooth contours and contacts

Dr. Johannes Bantleon *graduated from the University of Vienna (Austria) in 2010. After completing his studies he moved to London (United Kingdom) to further intensify his training in minimal invasive dental procedures. His main area of interest lies in direct composite techniques as well as indirect ceramic and adhesive procedures. He currently resides in Vienna working in a fully private practice.*

By **Johannes Bantleon**, Austria

In the modern society with its great focus on people's appearance, the demand for aesthetic tooth alterations has increased. With direct composites, a smile can be altered without or with minimal preparation of the teeth. If done properly, the aesthetic outcomes are very satisfactory and composites are often the preferred choice in younger patients. Very often, the patient's focus is on the desired shade, but there far more to it: colour is not the only thing responsible for a beautiful result.

Smile designing can be quite a challenge, especially because the perception of smile aesthetics can be individual and subjective. Next to the correct shade reproduction, thorough insight in the replication of tooth morphology and lustre are needed. It is a complex interplay of line angles, embrasures in which all aspects influence each other. This becomes even more apparent in the next two cases, where teeth were reshaped to create a harmonious appearance.

Reshaping canines into laterals and premolars into canines

Closing space to avoid the need for prosthetic maxillary lateral incisors has traditionally been considered a compromise since the aesthetics are inferior to those of the 'full smile'. Nevertheless, where appropriate, this option can produce very good results. When lateral incisors are absent, a decision needs to be taken whether the spaces are kept open for prosthetic replacement or orthodontically closed. Closing space has traditionally been considered a compromise since it poses aesthetic challenges.

Preoperative planning via DSD (digital smile design) or similar is helpful to define where to best distribute the additive composite masses. When applied appropriately, a very pleasing outcome can be obtained.

Fig 1a: Smile after orthodontic closure. **Fig 1b:** Close-up of the smile after orthodontic closure. Note the yellowish aspect of the canines, the large incisal embrasures and the leveled gingival design.

Fig 2: Digital Smile Design (DSD) of the desired tooth shapes.

Fig. 3a: Smile after reshaping the canines into laterals with Essentia (GC) composite. Fig **3b:** Close-up of the smile after reshaping. A very pleasing result could be obtained with direct composite restorations.

Some elements have to be kept in consideration:

1) Canines are often wider than the laterals they have to replace. In some cases, mesial and distal canine reduction might be necessary to obtain the correct ratio.
2) It might also be necessary to flatten the vestibular prominence of the canine. The three facial planes of the maxillary incisor can be evaluated best by viewing from the side of the tooth. Care should be taken not to overcontour the incisal third.
3) Canines are usually darker than laterals. In case the difference is too large to be masked with composite, vital bleaching might be necessary to obtain an optimal shade.
4) Canines have longer crowns than premolars; marginal gingival contours can be corrected with labial gingivectomy or clinical crown lengthening
5) Guiding contacts should be adjusted to the occlusion to avoid excessive wear. However, keep in mind that the palatal pulp horn might be large in children when grinding the cusp of the first premolar to adjust the occlusion.

Case 2: Diastema closure

Diastema between maxillary anterior teeth are often perceived as an aesthetic problem. The main challenge is related to achieving the correct dental proportions, especially from the central incisors. Proper gingival contouring and shade selection are other factors that deserve the utmost attention.

Some tips and tricks when closing diastemas:

1) The use of a silicone index is recommended to ensure correct dental proportions, especially when the diastema is large or multiple diastema need to be closed.
2) In case no silicone index is used, teeth are built up one by one, starting with the central incisors that needs the largest modification. A one-by-one approach allows for easier correction of the emergence profile and midline corrections.
3) A lot of attention should be paid to the placement of the matrices and wedge to obtain a natural emergence profile and to avoid ledges at the contact area, which could become an area for plaque and food retention. Choosing an optimal, matrix system to create the optimal convexity and smoothing with brushes can be useful to create a seamless transition.
4) Papilla repression with rubber dam avoids black triangle formation. The proximal embrasure area should be sufficiently exposed, e.g. by the use of ligatures.
5) Composites that are not slumping or sticking (e.g. Essentia from GC) should be used for this technique.

Fig. 4: a) Closeup of the smile before treatment; **b)** intraoral oblique view; **c)** intraoral frontal view.

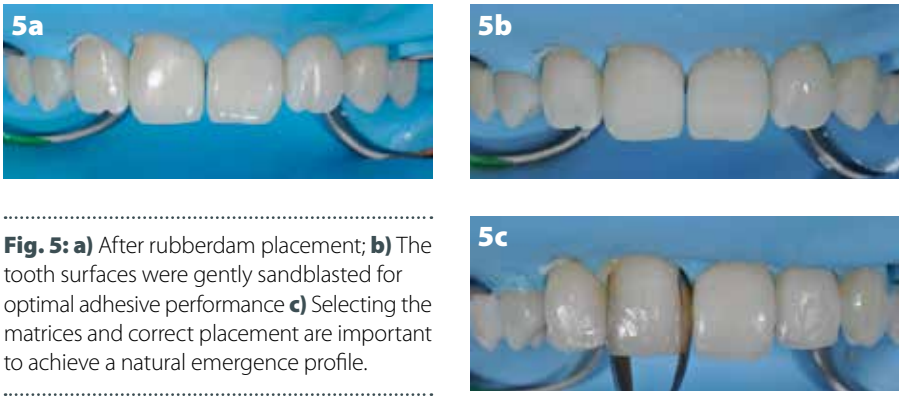

Fig. 5: a) After rubberdam placement; **b)** The tooth surfaces were gently sandblasted for optimal adhesive performance **c)** Selecting the matrices and correct placement are important to achieve a natural emergence profile.

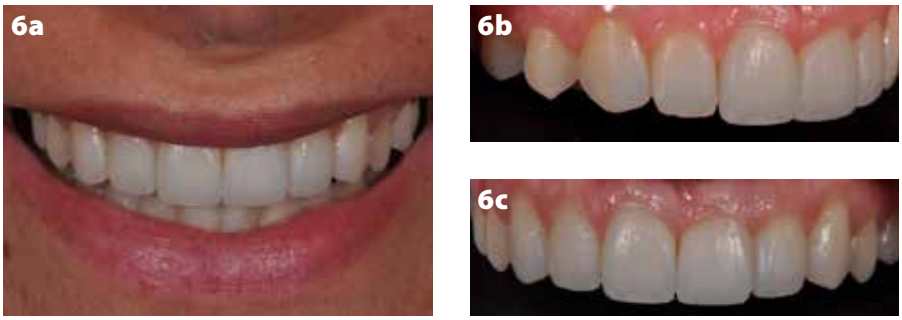

Fig. 6: a) Closeup of the smile after diastema closure with Essentia (GC) composite; **b)** intraoral oblique view; **c) i**ntraoral frontal view. The shade of the composite integrates well, seen from all directions, regardless of the incident light.

The more extensive the changes are, the more important the preoperative planning becomes in achieving a maximal aesthetic result. It is of utmost importance to properly discuss the treatment with the patient beforehand to exactly know what they desire and wish for. This enables the clinician to provide a personalized and individualized treatment plan.

References

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Restoring proximal caries lesions with a single shade stratification technique

By **Dr. Sergiu Muresan,** Romania

Dr. Sergiu Muresan *graduated from the Faculty of Dental Medicine of " Iuliu Hatieganu" University of Medicine and Pharmacy Cluj Napoca (Romania) in 2005. He has practiced his profession in his own dental office since 2007, as well as in cooperation with some clinics from Cluj Napoca and Turda. He is qualified in dental radiological diagnosis, his private practice focusing on aesthetic dentistry, especially on direct restorations (anterior and posterior). He has been an opinion leader for GC Romania since 2014. He holds conferences on the theme of direct restorations, in the private system as well as under aegis of societies, such as the Society of Esthetic Dentistry in Romania (SSER) and the Association of the Dentists with Private Practice in Romania, among others. Dr. Muresan has published articles concerning the clinical aspect of his work in several Romanian dental journals.*

One of the pathologies that we encounter the most in our daily restorative practice is proximal caries. Restoring Class II cavities in a proper way is very important in order to obtain a functional contact surface between the teeth. More than that, the secret to fabricate aesthetic and functional posterior restorations is to generate correct and precise occlusal anatomy.

In order to stay focused on morphology, we need to use a composite material which blends with the surrounding natural tooth structure, a material that works very well on posterior area and with which we do not need to spend time on shade selection (regardless of the colour of the natural tooth). The latter saves time in our everyday dentistry and makes our life much easier.

If we use the proper material, it has been well proven that single shade stratification technique solves the majority of cases correctly. Essentia Universal from GC meets all these requirements: great physical properties, easy handling and only one shade which matches beautifully with any natural tooth, indepent of its colour.

Fig. 1: Initial situation: old restorations with caries recurrence

The aim of this article is to show the steps of getting a functional and aesthetic Class II restoration using two viscosities of Essentia Universal.
The initial situation shows us imperfect old Class II restorations and new proximal caries (Fig. 1).

Fig. 2: Occlusion check before preparation

In order to better check the occlusion after we finish the restorations it is advisable to mark the occlusal contacts before making any preparation (Fig. 2).

Fig. 3: Preparations before rubber dam application

The preparations before the application of the rubber dam (Fig. 3).

After isolation, we have to complete the preparations and to perfectly finish the margins.

Fig. 4 a-b-c: Preparations after isolation. Teflon tape was used for proper isolation of the deep margins.

If the gingival margins of our preparations are too deep, we can use Teflon tape in order to obtain a proper isolation (Fig. 4).

Fig. 5 a-b: After sectional matrix placement, the enamel was etched and a two-step self-etch bonading applied.

Sectional matrices were used to build the proximal surface. Selective enamel etching followed by two-step self-etch adhesive application was chosen in order to get a proper adhesion. (Fig. 5)

Fig. 6 a-b: Essentia Universal LoFlo was applied onto the gingival margin to ensure a tight adaptation.

Because of its mechanical and aesthetic features, Essentia Universal LoFlo represents the perfect material to obtain a qualitative sealing at the gingival level of the preparation (Fig. 6).

Fig. 7: everX Flow was used as core reinforcement

Fig. 8: Restoration of the occlusal surface (Essentia Universal)

After the proximal wall was completed, a fibre-reinforced composite material was used for dentine replacement - everX Flow Dentin shade (Fig. 7) to prevent fractures.

The occlusal surface was restored using Essentia Universal (paste consistency), paying attention to the adaptation of the composite at the margin of the cavity (Fig. 8).

Fig. 9 a-b-c: Restoration of the first premolar following the same protocol

After the molar was finished, the first premolar was restored following the same principles. (Fig. 9).

Fig. 10 a-b-c: A separation ring was used to obtain a proper approximal contact.

Fig. 11: After the first finishing steps before removal of rubber dam

The restorations have a good integration, even though the morphology is not so elaborated (Fig. 13).

Essentia Universal represents a very good option to restore the posterior region, the more because we need something easy to use in our everyday dentistry: a material with good mechanical properties that blends with the surrounding natural tooth structure.

In order to get a functional contact surface, a separation ring was used when the second premolar was restored, to compensate for the thickness of the matrix and the polymerization shrinkage of the composite. Essentia Universal was used to build also the second premolar (Fig. 10).

The first steps of the finishing process were performed before rubber dam removal (Fig. 11).

One of the most important aspects from the functional point of view is to check if the occlusal contacts are correct (Fig. 12).

Fig. 12 a-b-c-d: Care must be given to a proper occlusion.

Figure 13 a-b-c: Final result with good integration of the composite.

From long fibres to nano fibres: evolution of the use of fibres in dentistry

Interview with **Prof. Pekka Vallittu**, Finland

Prof. Pekka Vallittu *has earned his degrees in Dental Technology in 1988, Doctor of Dental Surgery and Doctor of Philosophy in 1994, received Adjunct Professorship in 1995 and specialized in prosthodontics and stomatognathic physiology in 2000. Presently, he is a Full Professorship and Chair of Biomaterials Science in the Faculty of Medicine, University of Turku (Finland) and works as Dean of the Institute of Dentistry at the University of Turku and as the Director of Turku Clinical Biomaterials Centre. He holds Honorary Professorship at the University of Hong Kong, Pokfulam and Visiting Professorship at the King Saud University in Riayadh (Saudi Arabia). His predominating research activity on fibre-reinforced composites has lasted over 30 years since 1980´s. The first clinical applications of fibre-reinforced composites were found in clinical dentistry and thereafter in combination with bioactive component in bone surgical applications as non-metallic bioactive implants. He has over 540 ISI Web of Science Index original publications. He has established two companies for getting newly developed composite materials clinical use in dentistry and bone surgery.*

Could you please shortly introduce yourself?

Professionally, I started as a dental technician and later became a dentist as well. During my undergraduate course, from 1988, I already started with research on the use of several types of fibres to reinforce dentures. In 1994, I completed my doctoral dissertation on this topic. Shortly thereafter, I stayed for almost two years at the Nordic Institute of Dental Materials where I had the chance to do research with Dr I. E. Ruyter, one of the most renowned experts in polymer chemistry for dental applications. Here, I gained deep knowledge on that topic. Then, I returned to the University of Turku and I was one of the founders of Stick Tech (spin-off of the University of Turku, red.) in 1997. However, I made the personal decision to stay at the university rather than proceeding in the company, where I got governmental funding to continue research on fibre-reinforced composite. Through these many years of research, we had the chance to build a substantial amount of evidence and expertise in fibre-reinforced composites. In 2006 I became Professor and Chair of the Department of Biomaterials Science and in 2009, director of the Turku Clinical Biomaterials Centre (TCBC). I've been the Dean of the Institute of Dentistry of the University of Turku from 2004 to 2012 and after a short break, returned to that position in 2018.

In your opinion, what are the main advantages of fibres in dentistry?

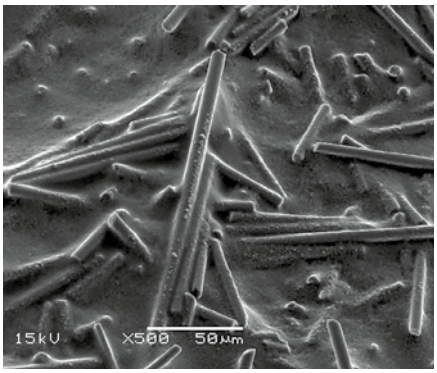
Fibres are the only way to make large direct restorations with good mechanical properties and durability. Other durable strong materials, such

as zirconia and metal can only be made indirectly, outside the mouth. This way we can provide more affordable restorations and allow a larger patient group to be treated. Another advantage is that the mechanical properties of fibre-reinforced composites are very close to those of bone and dentine, which is not the case with metals or ceramics, which are very rigid. Fibre-reinforced composites are the only synthetic materials which meet the same biomechanical demands as dentine or bone.

What was the purpose of developing everX Flow?

Research started with long fibres, used in the everStick products, which are the most durable ones. However, length is also a matter of designation, and appliances and restorations like splints and bridges that cover a wide span need a different length compared to a single tooth restoration. The main purpose with which we started the development of everX Posterior was to find the optimal fibre length vs. the size of the tooth, so that the fibres would act as reinforcement. This resulted in an average fibre length of 0.7 mm to 1 mm in everX Posterior, which provided excellent mechanical properties, and in particular, increased toughness. However, the adaptation and placement were not always as easy to achieve as we ideally would like to. Meanwhile, the bulk-fill composites emerged onto the dental markets and became popular, not because of their properties but because of their ease of use. Hence, the idea arose to develop a flowable version.

On one hand, we expected that shortening the fibres would decrease the properties. But, from studying the literature, we knew that the fibre length should be proportional to the diameter. Thus we started searching for what is called the 'Optimal Aspect Ratio'. The fibres in everX Flow are shorter, but also thinner. With these smaller fibres, the viscosity could be changed; the fibres in everX Flow are about 0.1 mm in length but with a much smaller diameter. The amount of fibres could also be increased, maintaining the toughness – which is the main purpose of the fibre reinforcement. Most of the research is focused on the toughness because it has been shown to be the best indicator of longevity of a restoration. [1]



SEM image of the glass fibres in everX Flow. Courtesy of Dr Lippo Lassila, University of Turku

What was your role in the development of this material?

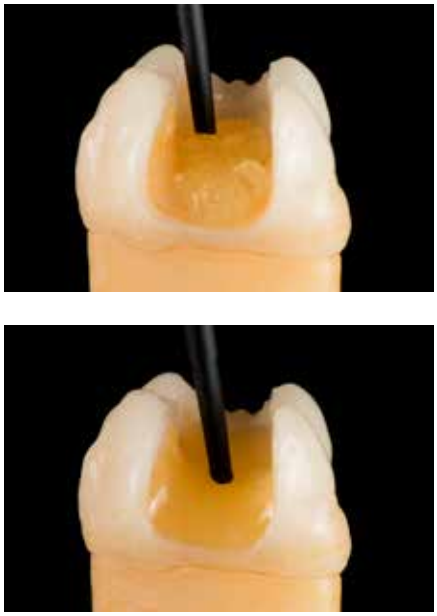
I have initiated and coordinated the development of FRC materials. The key lab research has been mainly executed by Dr. Lippo Lassila who is the principal investigator in this particular project with Adjunct Professor Sufyan Garoushi and our skilled laboratory staff members. Dr. Garoushi wrote a PhD thesis on short fibre-reinforced composites. Further on, I have participated in the clinical test phase and directed the project form the clinical and material science perspectives. The entire project was a cooperation in which TCBC was in charge of the research and development of the research and Stick Tech – now a member of the GC group – transformed the research into an industrial project.

You often refer to fibre-reinforced composites as biomimetic restorations. What exactly do you mean with this term?

When you analyse human tissue, dentine and bone are fibre-reinforced materials, based on collagen fibres and apatite minerals. Even though the chemical composition of fibre-reinforced composites is different, they reproduce a similar structure. Moreover, the biomechanical behaviour of these composites mimics that of dentine.

Are there other differences between everX Posterior & everX Flow? Do they have the same indications?

The indications are very similar, but the main difference is in the handling, because of the viscosity. Basically, they are both base materials to reinforce restored teeth. everX Flow is now also indicated as a core build-up material for metal and ceramic crowns.



The material keeps its shape during placement (top), but flows when it undergoes shear stress or 'disturbance' (bottom).

There are 2 shades available in everX Flow. What are the differences & when are they indicated?

The 'Bulk' shade: is more translucent and can be cured in layers up to 5.5 mm, which widens the indications a bit. The 'Dentin' shade is more aesthetic and can be cured up to 2.0 mm.

What is the difference between traditional bulk-fill composites and everX Flow?

In indications, they are very close to each other. However, everX Flow is a base material, meant to reinforce the structures underneath and above it. It needs to be covered with a regular composite that can be easily polished. Even though many bulk-fill composites need to be covered as well, in its strict definition, it should mean that you can use one and the same material from the bottom to the surface, in one increment.

How much stronger is everX Flow? What is the impact on performance?

Its toughness, which the most important material property impacting the clinical success[1] is twice as much as any other kind of composite on the market, which is also the case for everX Posterior. Its impact on the restoration performance depends on the size and shape of the destructed tooth and the ratio of everX Flow and overlaying composite. The ratio between the short-fibre reinforced base and conventional composite in the restoration should be analogue to the dentine and enamel structure. This means that about 1-1.5 mm of the occlusal surface should be regular composite in order to give the best mechanical strength for the restored tooth as a whole[2-3].

Less benefit is achieved if the layer of fibre-reinforced composite is not sufficiently thick[4].

As a rule of thumb, you use everX Flow to replace dentine and regular composite to replace enamel, thus mimicking tooth structure.

Do you need to cover everX Flow with a last layer of composite, and if yes why?

By structure, everX Flow contains both micro and macrofill particles. Fibres are big particles that make it slightly less polishable even though the wear resistance in vitro is very good. Based on the wear behaviour, it could be exposed in approximal contact points. However, the official instruction remains to cover everX Flow on the proximal surfaces with regular composite as well. More research is needed to analyse the effect in the long term, but available data are positive.

What does the research say about the performance of the product?

There is already a large number of publications available on everX Flow. On everX Posterior, we have even more evidence available. Almost all studies show superior properties of the material, such as the toughness or other mechanical properties. In vitro, it has been shown that fracture propagation is prevented in a restoration with fibre-reinforced composite. This is also the case at the interface of composite layers[5].

In those studies where no considerable reinforcing effect was found, the thickness of the fibre-reinforced layer was usually insufficient. Studies from other research groups have confirmed these superior mechanical properties and there are still many studies ongoing on this topic.

Could everX Flow be used to replace posts? If yes, in which indications?

At the TCBC, we have been looking in this topic a lot, in vitro as well as clinically, and many other research groups are doing so as well. Overall, more research on this topic is still

necessary. In molars, it is possible to make a direct endocrown without post by making a base of everX Posterior and this can be extrapolated to everX Flow as well. This type of endocrown is analogue to lab-made ceramic endocrowns. The restoration only extends about 2-3 mm into the root canals, given that the walls are parallel and diameter is sufficient. The intraradicular part of the restoration should have the same height or be higher than the coronal part.
The thickness of the occlusal veneer of the restoration should be more than 1-2 mm.

In anterior and premolars, studies have been done with very promising, but there is not enough evidence yet for clinical recommendation. However, it is possible to combine the pre-fabricated fibre post and use everX Flow in the coronal part of canal to replace cement and for the core. This is an improvement in comparison with a regular luting cement. Of course, results depend a lot on the remaining tooth structure. If there is considerable damage up to the gingival level a thick and well bonded fibre post is still needed for sufficient retention. Evidence might be available within 2-3 years.

What are your future research topics?

Tomorrow I'll be giving a lecture on the masticatory function of giant pandas and the evolutionary adaptation of the condyles to that function. In the field of fibre-reinforced composites, we strive to an even closer resemblance to natural dentine; among others we are investigating nanofibres, and compositions and structure closer to apatite minerals. We are also cooperating with another research group to extended indications in surgical applications, taking into consideration the biological aspect of bone forming cell lines. This is linked also to the bone regeneration materials used in periodontology and oral surgery.

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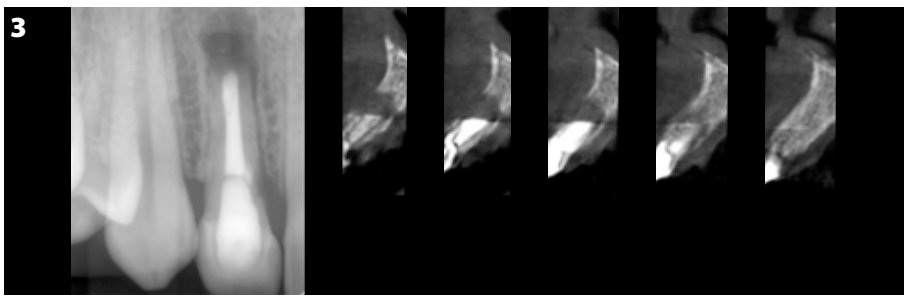
Handling a challenging case in the anterior area with implants

By **Dr. David Garcia-Baeza**, Spain

Dr. David Garcia-Baeza *obtained his degree in dentistry at the European University of Madrid (EUM) in 2002. In 2006 he obtained the certification in implant and oral rehabilitation, also from EUM. He now runs a private practice at the CIMA center in Madrid, Spain, which is dedicated to aesthetics, restorative dentistry and implants. He is an Associate Professor in the Department of Periodontology at UEM and Assistant Professor in the Department of Aesthetic Dentistry at the Complutense University of Madrid. He is also member of the EAO (European Association of Osteointegration), SEPES (Spanish Society of Prosthodontics) and SEPA (Spanish Society of Periodontology). He has several publications in international journals and has given many national and international lectures on aesthetic and restorative dentistry.*

A patient presented with a fistula in the apical area of the lateral incisor n°12. The tooth was treated endodontically and with a crown (Fig. 1). The fistula could be entered with a probe (Fig. 2) and radiographically, we could see an apical deficit and an active infection (Fig 3a). The endodontic treatment was failing and not recovering correctly. On the CBCT (Fig 3b), we could see a loss of bone density in this apical area at the vestibular side. Therefore, due to the pain and

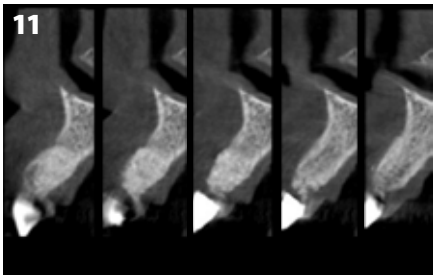


shows the final situation of the surgery and two weeks later, and it can be seen that everything had healed correctly.

hypermobility of the tooth, it was decided to extract it and to restore the tooth with an implant. Two routes could have been taken: either an immediate implant placement, or a postponed placement. An immediate implant could be possible because there is sufficient apical bone to stabilise the implant. However, because the patient already had an endodontic problem and a failed treatment, we decided to take as little risk as possible: extraction followed by alveolar preservation with a low resorption biomaterial, trying to maintain the volume to the maximum and postponed implant placement.

We therefore proceeded to the extraction (Fig 4). The socket was filled with a biomaterial with low resorption to maintain the volume, but as the literature indicates, we may expect to lose a bit of volume in an area as critical as the anterior area. Therefore, we would also carried out an envelope technique which included the placement of a connective tissue graft reaching the mucogingival line. The graft was stabilised at the vestibular and then the palatal side with sutures (Fig. 5). The intention was to compensate the volume that will disappear and try to maintain and restore the situation as it was before the extraction. Once the extraction and the palatal connective tissue graft had been carried out, we continued with the patient's tooth. The root was cut and only one millimetre was left to maintain the coronal volume of this area. Figure 6

In this case, we allowed several months (4 to 6 months) to let everything heal so the tissues could stabilize. The patient was wearing a mouth splint (Fig. 7) in case there would be any issue of loosening, even at night and because it is beneficial to relieve stress. The mouth splint was subsequently used at the day of the surgery. The tooth that was adhered to the two adjacent teeth was removed (Fig. 8) and it can be seen that the volume has been maintained several months later (Fig. 9). Looking from the front (Fig. 9), and perhaps more interestingly for us, the occlusion (Fig. 10), a concavity could be seen from that millimetre of root that was left on the provisional. The volume had been maintained, not only in the apical and middle part that we had

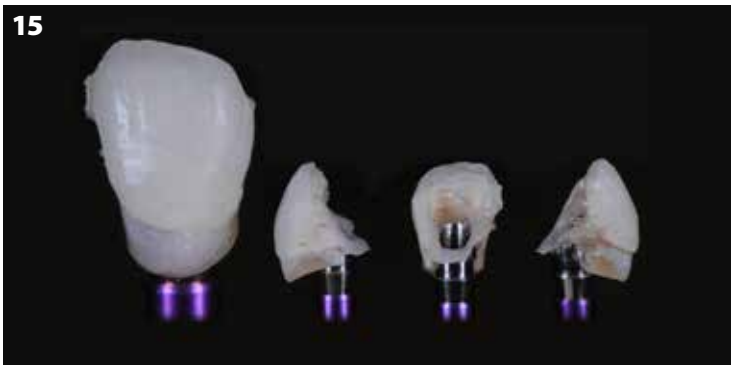


made surgically with the bone regeneration and connective graft, but additionally that the provisional had helped to shape the coronal anatomy of that gingival section.

A new CBCT scan (Fig. 11) showed that the slowly resorbing material had behaved correctly. Sufficient volume was established in the area of the root and the failure due to the apical infection. The ideal conditions for placing an implant had been created: native bone was present in the apical section and regenerated bone in the middle and coronal section.

As the transparent mouth splint was available, which would indicate the final position of the crown, it was used to carry out the whole drilling sequence per manufacturer's instructions (Fig. 12). In this case, we decided to place a 4 x 12 Aadva tapered implant, seeking primary stability in the bone that may not have

the hardness of fully regenerated bone, but seeking the apical section which would stabilize the implant (Figs. 13-14). A tapered implant, sufficiently long to go beyond all the regenerated bone and reach the section of native bone where it would be stabilized was therefore selected, achieving sufficient primary stability, even to load the implant. We again used the provisional (Fig. 15), the initial crown was left attached to the neighbouring teeth, and was loaded immediately to adapt it to the clinical situation and the



implant that was just placed. Logically, it was left out of occlusion and a waiting period of about 8 weeks was respected for the correct osseo-integration of the implant. As can be seen on the radiograph (Fig. 16), everything functioned correctly, and after three months the provisional

could be disconnected. The gingival anatomy was correct and we had not taken any risk. That is, instead of immediate implant placement and immediate loading, we decided to postpone. A socket preservation was carried out on the day of the extraction and the implant was placed in a bone without any kind of infection in a later phase. The volume was maintained, firstly with the primary technique, the technique of immediate connective alveolar-graft preservation, the subsequent placement of an implant, easily and reliably, while all the work on volume preservation was already done with the previous surgical technique. Therefore, the implant must only have sufficient primary stability before placing the provisional, in this case the same one worn by the patient which had made up the anatomy we saw in the anterior images, and now that connection between the implant and the crown will give us the emergency profile we were seeking for the final crown (Fig. 17). Next, an impression was taken along with the patient's tooth shade (which in the anterior area is always complicated) (Fig. 18). A restoration was manufactured, in this case with zirconium, restoring both the aesthetic and the function, to achieve a beautiful final result (Figs. 19 and 20).

Indirect bonding of brackets for predictable orthodontic results

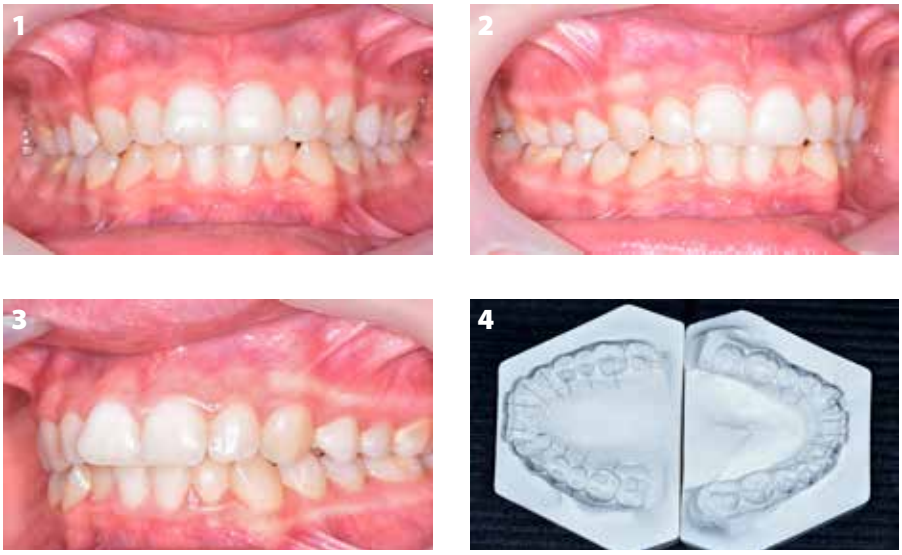
By **Dr. Aleksandra Podoleshova,**
North Macedonia

Dr. Aleksandra Podoleshova *first finished secondary medical school for dental technicians. She graduated at the University Ss. Cyril and Methodius, Skopje (North Macedonia) in 2001. She received her Master Diploma in 2009 and specialty degree in Orthodontics 2010. From 2002 to 2011, she has been working at the Department of Orthodontics, PHO University Dental Clinical Center- St Pantelejmon, Skopje. She is practising lingual orthodontics since 2009 as her main clinical interest. Since 2011, she has been working in a private practice fully oriented on aesthetic orthodontics and restorative dentistry, practising orthodontics with self-ligating systems and giving courses in the field of 2D lingual orthodontics. Her interests include: Interdisciplinary orthodontic treatments, full mouth rehabilitation with labial and occlusal prefabricated veneers with primary concentration in altering dental occlusion, the temporomandibular joints and comprehensive aesthetic orthodontics and restorative dentistry according to the Dawson Academy principles.*

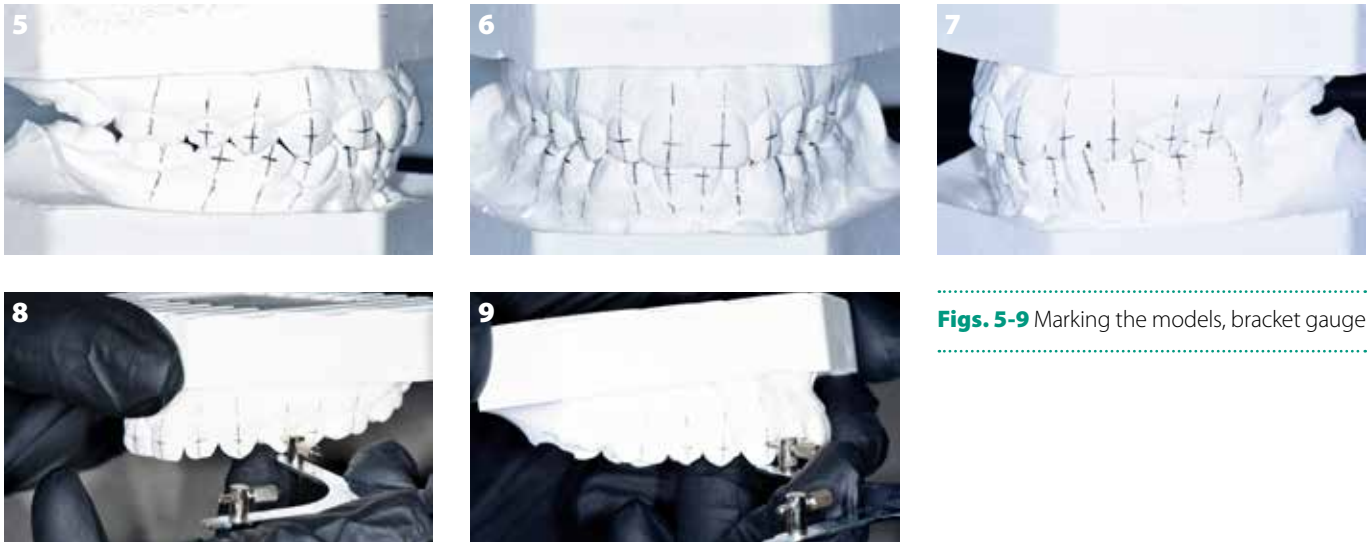
Indirect bonding is a procedure which includes bonding of the brackets on the models, transferring them with a tray and bond them in the patient's mouth. It is a procedure that can be done by a dental technician in laboratory under supervision of an orthodontist or it can be done in the orthodontic practice; it doesn't require special technical skills or equipment. Indirect bonding has several advantages compared with direct bonding. The procedure is very accurate and precise: since we do not have saliva and gums on the models, we can analyse and inspect the long axis of the teeth and confirm them with a panoramic. On the other hand, less chair-time is needed with indirect bonding, which reflects on the comfort of the patient and the practitioner's self-confidence. Since indirect bonding is more accurate, less wire bending is needed during the treatment. Also, the need for repositioning of the brackets is eliminated. EXACLEAR (GC) silicone is a material that perfectly matches the needs for indirect bonding procedure, given its transparency and optimal elasticity, which does not allow for it to tear while transferring.

A 14-year-old young girl came with her father to the office asking for orthodontic treatment. Her chief complaint was crowding of the front teeth (Figs. 1-3). She wanted to improve her smile by straightening the teeth. After clinical and radiographic examination, impressions for study models (Fig. 4) were taken for diagnostic purposes. The treatment plan was made accordingly and several treatment options were offered to the patient. It was decided to go for an orthodontic treatment with Bioquick self-ligating brackets (Forestadent).

The models were prepared first by marking the long axis of the teeth with a pencil (Figs. 5-7). With a bracket gauge, the estimated height where the brackets should be bonded, was marked (Figs. 8-9).



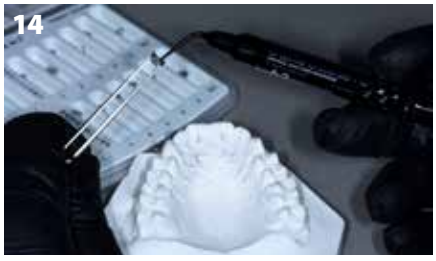
Figs. 1-4 Initial situation



Figs. 5-9 Marking the models, bracket gauge

Thereafter, GRADIA SEPARATOR (GC) fluid was applied to the model (Fig. 10). It fulfils perfectly the goals for secure and easy removal of the brackets from the model without leaving any residues.

The brackets were bonded onto the models on previously marked positions with G-ænial Universal Flo (GC) and light-cured (Figs. 11-16).



Figs.11-16 Bonding brackets on the models using G-ænial Universal Flo

Next, a non-perforated metal impression tray was filled with a transparent vinyl polysiloxane material (EXACLEAR) and placed over the stone model. A small amount of the silicone was placed directly over the brackets to avoid bubbles (Figs. 17-19).

Figs. 17-19 Applying EXACLEAR in metal tray to produce transfer for the brackets. Some silicone was placed directly over the brackets to avoid bubbles.

A smooth tray without perforations for retention was used with the purpose to achieve a smooth surface of the transfer mould and to be easily removed from the silicone (Figs. 20-21).

Figs. 20-21 Removing the metal impression tray from the silicone

The transfer tray with the brackets should be removed from the plaster model which is easily done due to the applied GRADIA SEPARATOR fluid (Figs. 22-23).

Figs. 22-23 Separating transfer tray from plaster model

The transfer trays were cut to the appropriate height with a scalpel, then sandblasted with 100 µm Al2O3 and rinsed with water to remove the sand residues. It is not needed to completely remove the adhesive from the bracket base (Figs. 24-25).

Figs. 24-25 Sandblasting of the bracket base

The teeth were cleaned with non-fluoridated prophy paste, and the vestibular surfaces were etched during 20 sec. (Fig. 26) and thoroughly rinsed with water spray. Afterwards, the surface had a frosty appearance.

Fig. 26 Etching of the teeth

A universal adhesive (G-Premio BOND, GC) was applied on the bracket base and light-cured (Fig. 27). The bond was also applied on the teeth, left for 10 sec. and blow dried for 5 sec. and light-cured (Fig. 28).

Figs. 27-28 Applying universal adhesive (G-Premio BOND, GC)

Light-cure adhesive cement was applied on the brackets base and then the transfer was placed over the teeth (Fig. 29). The brackets were light-cured starting from the most posterior teeth towards the anterior teeth. EXACLEAR is a truly clear silicone that enables clear and visible working field and easy penetration of the light. The used light-curing source should have more than 1500 mW/cm^2.

Fig.29 Light-curing occurs through the silicone transfer

The transfer was cut in sections (Fig. 30) and removed from the teeth with a ladmore (Figs. 31-32).

The indirect bonding technique with the EXACLEAR silicone transfer tray enables orthodontists to provide orthodontic treatment with predictable results even in the most complex cases. It is a simple technique that can be powerful aid in everyday routine in orthodontic practice.

Figs. 30-32 Removing the transfer sections

The chairside use of a dual-cure composite for temporary restorations

By **Dr Janine Sohota**, United Kingdom

Dr Janine Sohota *graduated in 2012 from Birmingham Dental School (United Kingdom). She has worked primarily in private practice for 6 years now and has a special interest in cosmetic dentistry and smile makeovers. Janine has obtained a postgraduate degree in Implant Dentistry at the London College of Oral Implantology and regularly attends dental courses to ensure her practice is dynamic and progresses with the current surge in the demand for cosmetic dentistry in the UK.*

Cosmetic dentistry has rapidly been gaining momentum over the past decade but now it is not just for the wealthy. Many more patients are choosing to invest in their smile, there is ever increasing demand for dental practitioners to be able to provide beautiful, aesthetic results for a diverse range of patients. Any dentist providing crown-and-bridge work must be able to place high-quality temporary restorations which do not only look good but are also durable to withstand masticatory forces whilst the final restoration is manufactured.

What do we desire from our temporary restorations?

- Look natural and aesthetic. Patient's having dental work don't want it to be obvious that they are amidst treatment.
- Maintain the soft tissue. Particularly anterior restorations, if the soft tissue is not respected by a well fitting temporary then there is danger the gingiva could recede, leading to black triangles which could compromise the aesthetics.
- Provide function for mastication. We need temporaries to last, they need to be durable so a patient can still function as normal.
- Maintain the occlusion and space. A temporary will prevent adjacent tooth movement and drifting as well as preventing over eruption. Hence, when the final restoration is delivered, there should be no occlusal interferences.
- Ease-of-use for a general dentist for a quick chairside construction.

The two cases below aim to show the importance of a correct provisional for the long term success of a treatment.

Case 1: a fractured central incisor

Fig. 1: Fractured incisor #21

A 65-year-old gentleman presented to me as an emergency patient. His upper left central incisor had severely fractured (Fig. 1). Luckily, there was no pain or any pulpal exposure. However, it was not a good indication for a direct restoration. After radiographs and vitality testing, it was decided to restore the tooth with a crown. The shading of the adjacent teeth was extremely varied with the most unusual presentation, particularly on the upper right central incisor. It is known that the most challenging treatment for a dentist is the replacement of one single central incisor.

Luckily, the patient had brought along the fractured portion of his tooth (Fig. 2).

Fig. 2: The detached tooth fragment

I reattached this piece using G-ænial Universal Flo X (GC) composite for the purpose of taking an alginate impression that I would then use after the preparation to make a chairside temporary with TEMPSMART DC (GC).

The treatment plan:

- Prepare tooth abutment for a zirconia crown with buccal porcelain layering. This would enable an aesthetic outcome with the desired effects on the buccal surface to include translucency and micro-fracture lines.
- Take a two-stage putty wash impression using retraction cord.
- Note stump shade of abutment and photograph for the ceramist
- Construct chairside temporary crown using TEMPSMART DC (GC), shade A2 and affix with temporary cement (Fig. 3).
- Wait two months before placing the crown to leave sufficient time for assessment of a possible devitalisation after preparation.

Using the VITA Toothguide 3D-MASTER® (Vita), a detailed lab sheet was sent to the ceramist. This was by no means a beautiful case or a smile makeover with bright white teeth but rather a case of accepting nature and mimicking the adjacent teeth which was all the patient wanted. He had no desire for a smile makeover or whitening, he just wanted his front tooth back.

Fig. 3: TEMPSMART DC dual-cure composite for temporary restorations

The tooth was vital and asymptomatic; despite the limited amount of tooth tissue there was certainly an adequate ferrule (Fig. 4), which is the key to retention and longevity of the crown. Hence, an elective root canal treatment and post placement, could be avoided. Recent studies show that the insertion of a post does not enhance the load-bearing capacity of an all ceramic crown[1].

Fig. 4: Rough preparation before final polish and refinements

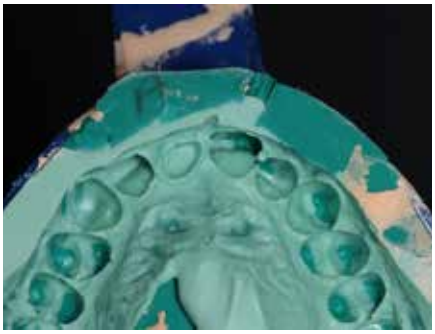


Fig. 5: Two-stage putty wash impression of the preparation

Using the preoperative alginate (Fig. 5), a temporary crown was fabricated and inserted with temporary cement (Fig. 6). TEMPSMART DC has excellent handling properties and the fact that the setting process can be increased by the dual-cure function ensures a good final result. There were no air bubbles or voids which unfortunately I have learnt to expect with other materials.

Two months later, the temporary crown was removed. The interdental papillae had been maintained and there had been no issues with fracture or displacement of the temporary crown. No hypersensitivity was reported and the tooth had remained vital. The zirconia crown was placed, looking natural, full of the desired characteristics (Fig. 7).

An upper night guard was created because of the patient's traumatic edge bite to prevent any overnight shear/tensile forces from displacing the crown.

The tooth is to be monitored now, and the patient was informed that a future root canal treatment may be required if late pulp complications would occur.

Fig. 6: Temporary restoration with TEMPSMART DC

Fig. 7: Final restoration (a) intraoral view; (b) detailed intraoral view; (c) smile

Case 2: replacing an old porcelain fused to metal (PFM) bridge

This next case was much more straightforward.

A patient presented with a lower left quadrant 3-unit bridge (PFM). It had been present for some years but recently the porcelain had chipped off exposing the underlying metal. The patient found the sight of metal in his mouth unacceptable and requested a replacement bridge.

After making radiographs and a full clinical examination, I decided we would remove the old bridge and re-prep for a monolithic zirconia bridge. This has the advantage that this material has an increased fracture resistance (1200 MPa).

The patient was very conscious about the temporary restoration needed during the two weeks in which the bridge would be fabricated. He had recently completed Invisalign treatment and wanted to ensure that the temporary bridge was compatible with his retainers so as to prevent any unwanted tooth movement.
Once the bridge had been removed and re-prepped, pre-operative alginate was used to construct a temporary bridge with TEMPSMART DC (Fig. 8).

Fig. 8: Temporary bridge made with TEMPSMART DC

After some finishing/trimming, it was filled with temporary cement (Fig. 9) and then placed *in situ* over the abutments (Fig. 10).

Two weeks later, the final bridge was delivered (Figs. 11 and 12); the occlusion was stable and no adjustment was needed.

Conclusion

The ease-of-use of TEMPSMART DC was excellent; the ability to dual-cure with a curing light increased the speed at which a temporary can be placed therefore allowing appointment times to be utilised efficiently. I also found it easy to adjust and trim the restorations with just scissors, which I prefer. All temporaries lasted during the entire time in function.

Fig. 9: Temporary bridge before cementation

Fig. 10: Temporary bridge in situ

Fig. 11: Final zirconia bridge (a) occlusal view; (b) intaglio surface

Fig. 12: Final zirconia bridge. Intraoral after placement

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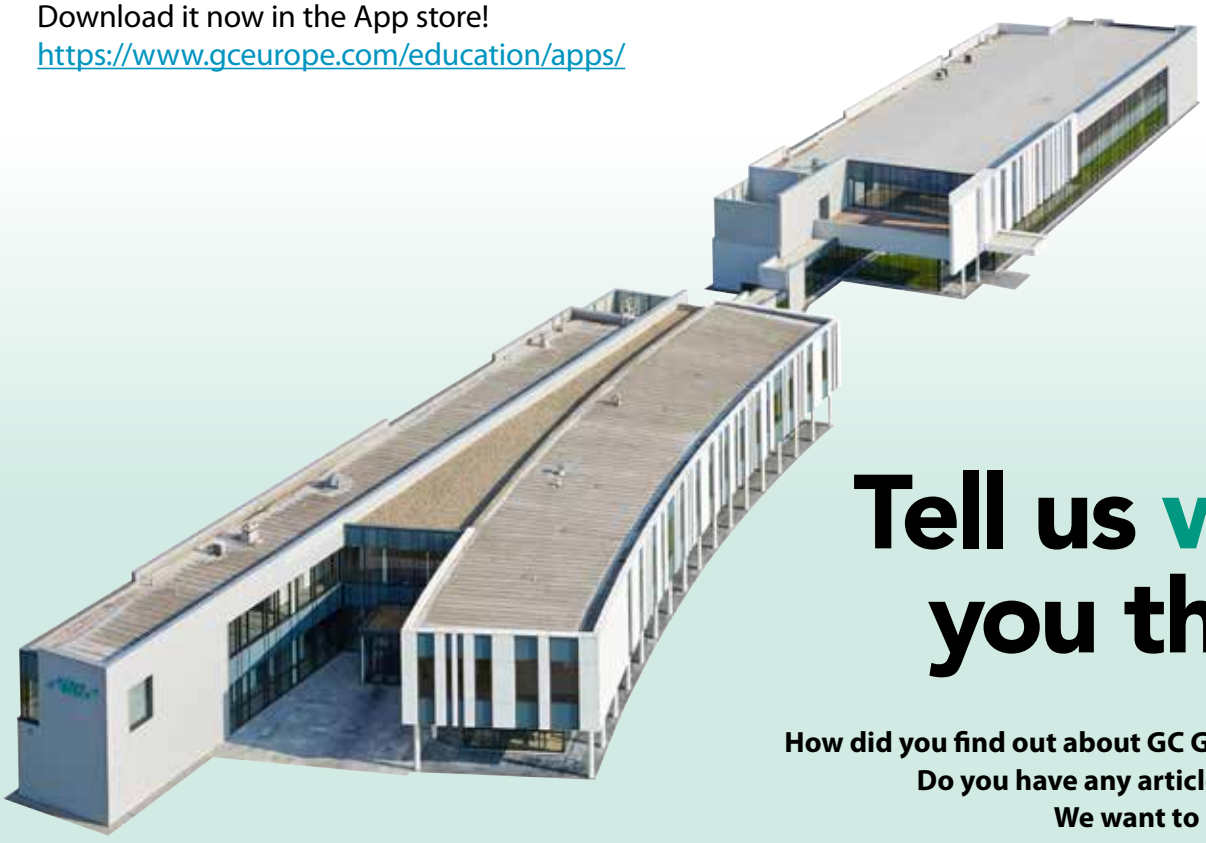

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GC Europe NV
Benelux Sales Department
Researchpark
Haasrode-Leuven 1240
Interleuvenlaan 13
B-3001 Leuven
Tel. +32.16 74.18.60
info.benelux@gc.dental
http://benelux.gceurope.com

GC UNITED KINGDOM Ltd.
Coopers Court
Newport Pagnell
UK-Bucks. MK16 8JS
Tel. +44.1908.218.999
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info.uk@gc.dental
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GC FRANCE s.a.s.
8 rue Benjamin Franklin
94370 Sucy en Brie Cedex
Tél. +33.1.49.80.37.91
Fax. +33.1.45.76.32.68
info.france@gc.dental
http://france.gceurope.com

GC Germany GmbH
Seifgrundstraße 2
D-61348 Bad Homburg
Tel. +49.61.72.99.59.60
Fax. +49.61.72.99.59.66.6
info.germany@gc.dental
http://germany.gceurope.com

GC NORDIC AB
Finnish Branch
Bertel Jungin aukio 5 (6. kerros)
FIN-02600 Espoo
Tel: +358 40 7386 635
info.finland@gc.dental
http://finland.gceurope.com
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GC NORDIC AB
Danish Branch
Scandinavian Trade Building
Gydevang 34-41
DK-3450 Allerød, Danmark
Tel: +45 51 15 03 82
info.denmark@gc.dental
http://denmark.gceurope.com

GC NORDIC AB
Strandvägen 54
S-193 30 Sigtuna
Tel: +46 768 54 43 50
info.nordic@gc.dental
http://nordic.gceurope.com

GC ITALIA S.r.l.
Via Calabria 1
I-20098 San Giuliano
Milanese
Tel. +39.02.98.28.20.68
Fax. +39.02.98.28.21.00
info.italy@gc.dental
http://italy.gceurope.com

GC AUSTRIA GmbH
Tallak 124
A-8103 Gratwein-Strassengel
Tel. +43.3124.54020
Fax. +43.3124.54020.40
info.austria@gc.dental
http://austria.gceurope.com

GC AUSTRIA GmbH
Swiss Office
Zürichstrasse 31
CH-6004 Luzern
Tel. +41.41.520.01.78
Fax +41.41.520.01.77
info.switzerland@gc.dental
http://switzerland.gceurope.com

GC IBÉRICA
Dental Products, S.L.
Edificio Codesa 2
Playa de las Américas 2, 1°, Of. 4
ES-28290 Las Rozas, Madrid
Tel. +34.916.364.340
Fax. +34.916.364.341
comercial.spain@gc.dental
http://spain.gceurope.com

GC EUROPE N.V.
East European Office
Siget 19B
HR-10020 Zagreb
Tel. +385.1.46.78.474
Fax. +385.1.46.78.473
info.eeo@gc.dental
http://eeo.gceurope.com