GC get connected¹⁴ Your product and innovation update





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GC get connected Your product and innovation update



Dear readers Welcome to the 14th edition of GC's Get Connected newsletter.

GC develops dental products always having the convenience of the clinician in mind.

Among the cases of this fourteenth edition, you will find a full upper arch rehabilitation by means of a complete digital workflow including a 3D printed temporary bridge.

With another CAD/CAM material, the nanohybrid ceramic CERASMART 270, it was possible to restore heavily damaged teeth in the posterior region in a cost-efficient way, fully relying on adhesion and by using the immediate dentin sealing technique.

Within direct restoratives, high-strength composites with optimized handling, such as G-ænial Universal Injectable, open up entirely new possibilities. By using the injection moulding technique it was possible to restore several defects in the anterior region in a fast and minimally-invasive manner and with a predictable esthetic outcome.

These are only a few examples to illustrate that high-end dentistry is becoming more and more accessible for dentists as well as patients -a benefit for all!

Please enjoy reading and do not hesitate to contact GC if you would like to join one of our courses in our training centre or for any upcoming questions.

Dr. André Rumphorst

General Manager Marketing & Product Management GC Europe NV



Dr Anthony Mak obtained his dental degree at Sydney University (Australia) and then went on to complete his post-graduate diploma in Oral Implantology. He graduated with multiple awards and has worked with some of Sydney's most renowned practitioners. His interests lie in dental technologies and advances in materials and techniques. He has a unique understanding in CAD/CAM Digital dentistry and currently owns two practices in metropolitan Sydney focusing on comprehensive and implant dentistry. Anthony has a thorough understanding of direct vs indirect dental restorations and has lectured internationally on the topics of Aesthetic and Digital Dentistry. He is a sought after speaker and is a key opinion leader for several global dental companies.



Dr. Andrew Chio graduated as a dentist at the top of his year from the University of Melbourne (Australia) in 1995. On graduation he then undertook his dental internship at the Bendigo Base Hospital before spending the next one and a half years working in a rural hospital in Nepal. He is the principle dentist of Arawatta Dental Centre in Carnegie and an active member of various dental associations. He is a lecturer and gives advanced hands-on trainings to dentists in specific areas of restorative dentistry.

A full digital workflow with 3D-printed temporary restorations

By **Dr Anthony Mak** and **Dr Andrew Chio**, Australia

The evolution of digital technologies in dentistry has paved the way for the development of simplified and predictable protocols in field of restorative dentistry. Digital dental technologies have allowed the seamless delivery of complex treatments.

Proper treatment planning protocols are the foundation of any fixed restorations in the arch involving dental implants. The data or information from the CBCT scan and intraoral surface scans (IOS) combined with the use of CAD software allow the simplification of workflows including diagnostic facially driven mock-ups, restoration-driven implant treatment planning and the design and fabrication of surgical guides. The design of the temporary and permanent prosthesis and the design of the master die model can all be done on CAD software and then manufactured either with 3D

printing or milling. The prosthetic design can be visualized, planned and even designed prior to the patient even attending for the surgical phase of treatment.

An accurate and predictable outcome of the implant surgery as well as the restorative rehabilitation are realised this way.

The following case study demonstrates a scenario where a complete digital workflow was utilised with two provisionalisation phases to rehabilitate the full upper arch.

Case report



Fig. 1: Pre-operative smile and orthopanthomogram.

Diagnostic Record Collation and Treatment Planning Phase

A 79-year old patient presented with an unremarkable health history.

Chief complaint:

- mobile teeth
- occasional discomfort from the areas around his existing upper fixed partial denture

Examination (both clinical and radiographic) indicated the following (Fig. 1):

- moderate to advanced bone loss affecting many of his upper and lower teeth.
- secondary decay was diagnosed on the abutments of his fixed dental prosthesis.
- Teeth 15, 16 and 28 had a poor prognosis and were planned for extraction.

The goal of the treatment was to rehabilitate the upper arch with a combination of crowns and implant retained restorations to provide the patient with a fixed solution. In the initial treatment phase, teeth 16 and 28 were extracted and the



Fig. 2: Occlusal and lateral view after periodontal treatment and extraction of tooth 16 and 28.



Fig. 3: The accuracy of image registration between the CBCT and IOS scans can be improved with radiographic markers (composite blobs). Removing sources of radiographic scatter (in this case, the PFM bridge) also improves the accuracy.

remaining dentition was periodontally treated (Fig. 2).

After the initial clinical examination and treatment, further information was collated. This included:

- 3D CBCT scanning for the presurgical planning.
- Intra-oral scans (IOS): digital impressions before and after removal of the original PFM bridge were taken, as well as the patient's occlusion (bite). Rough preparation of the tooth abutments were also completed prior to the acquisition of the subsequent IOS scan.

Tip: the accuracy of image registration (superimposition of the IOS and CBCT data) can be enhanced by (Fig. 3):

- the use of radiographic reference markers: a composite such as G-ænial Universal Injectable with a radiopacity of 250% Al, does not result in radiographic scattering during CBCT scans.
- prior removal of the porcelainfused-to-metal (PFM) bridge: reduction of radiographic scatter caused by the metallic components of the prosthesis

Treatment Plan

Following the collation of the information, the initial treatment plan was formulated and involved:

- Guided surgical placement of implant fixtures in the 16, 14, 11, 21 and 25 sites. A bone graft was also planned in the 11 site due to bony defects. A two-stage surgical protocol was chosen for proper integration of the implants in the 11 and 21 site.
- Immediate provisionalization with a 3D-printed temporary bridge (GC Temp PRINT) from 15 to 24. The existing shape and contours of the current failing bridge were copied from the pre-operative IOS to create the temporary bridge.
- After implant integration, a second phase of provisionalization was foreseen with individual temporary restorations (GC Temp PRINT) on the implants and natural teeth. This allowed:
 - Verification of aesthetics and occlusion
 - Soft tissue management
 - Extraction of tooth 15.



Fig. 4: Intraoral surface scans (IOS) before and after removal of the original PFM bridge superimposed on the CBCT scan: this facilitates the planning of implant placement from a restorative perspective (restoration driven implant placement).



Fig. 5: Planning of implant placement. A surgical guide is designed based on the desired implant position.

• It was planned to use lithium disilicate and monolithic zirconia for the permanent restorations on both the natural teeth and implant abutments.

Digital Implant Planning and Surgical Guide Fabrication

Digital data from the three scans – the CBCT and the IOS before and after bridge removal - were accurately merged. This enabled virtual planning of the number, position, angulation and access position of the implant fixtures following a restoratively driven protocol (Fig. 4).

Based on the planned implant positioning (Fig. 5), a surgical guide was designed with the dedicated software. Master sleeves from the guided surgical system were placed and fixed to the printed guide/ framework.

The design of the previous PFM was also copied and replicated in the digital planning of the temporary bridge. It was then printed using the Asiga Max UV and GC Temp PRINT (medium shade) set at 50µm on the 3D printer.

Guided Implant Surgery and First Provisionalization Phase

The following clinical procedures were then completed on the day of implant surgery:

- All five implant fixtures were placed following a fully guided surgical protocol with the surgical guide (Fig. 6) and primary stability was confirmed.
- A flap was raised in the 11-21 region, a bone graft with bovine cancellous particulate was placed and covered with a porcine collagen membrane. Cover screws were placed and primary closure was established after a relieving incision and closed with PTFE sutures. At the other implant sites (16, 14 and 25), healing abutments were placed (Fig. 7).



Fig. 6: Five implant fixtures were placed using a fully guided surgical protocol.



Fig. 7: A flap was raised in the 11 region as buccal bone grafting was required due to a bony defect.

• The 3D-printed temporary bridge was then cemented with GC Fuji TEMP LT on the remaining natural teeth (Fig. 8).

A healing period of 16 weeks allowed complete osseointegration of the implant fixtures. During this period, tooth 24 (upper left first premolar) developed signs and symptoms of pulpal necrosis. Hence, it was endodontically treated (Fig. 9).





Fig. 8: Immediate post-operative following guided implant surgery and temporary cementation of the provisional fixed bridge printed from GC Temp PRINT (medium shade)



Fig. 9: During the healing phase, tooth 24 developed pulpal necrosis and was endodontically treated.

Second Provisionalization Phase after Implant Integration.

Once the 16-week healing phase was completed and the fixtures were integrated, the restorative phase could be initiated. The patient confirmed that he was happy with the shape and occlusion of the initial temporary bridge (Fig. 10). The aesthetic and occlusal scheme could therefore be replicated in the second phase of provisionalization.

A pre-preparation IOS was taken with the healing abutment and temporary bridge in situ (Fig. 11).

The temporary bridge was then removed and preparation of the abutment teeth finalized and remargined to the healed gingival tissue levels.

Stage 2 implant surgery on the 11 and 21 sites was completed using a soft tissue diode laser. The implants were exposed and cover screws removed.

An emergence profile scan was taken immediately after the healing abutments were removed to record gingival contours around the implant before any collapse of the tissues. Next, the full upper arch was scanned with digital scan bodies in place to capture the implant position accurately (Fig. 12).

All other prosthodontic records including the bite registration and the opposing arch were also captured with the intra-oral scanner before placing the temporary bridge back. All IOS were taken following the



Fig. 10: View at 10 days after implant surgery.



Fig. 11: Pre-operative surface scan



Fig. 12: Periapical radiographs to verify the seat of the digital scan bodies.

"Mak optimised scan strategy" (MOSS), allowing accurate stitching of IOS images. In soft tissue "pink" areas, the availability of landmarks is often limited; MOSS uses a specific scan path with or without markers for an enhanced scan accuracy and was especially designed for cases with few teeth to correlate to. All the digital data was then sent to the ceramist for the fabrication the second set of provisional restorations.

Provisional restorations were printed with GC Temp PRINT and characterised with OPTIGLAZE color (GC). Temporary abutment cylinders were utilised for the implant-retained



Fig. 13: Second set of provisional restorations printed with GC Temp PRINT (medium shade) using the Asiga Max UV 3D printer.



Fig. 14: Completed provisional crowns, implant retained crowns and bridge, characterised with OPTIGLAZE color (GC) – Dental technician: Brad Groblar, Oral Dynamics, New Zealand.

restorations. The contours of the 11 and 21 implant-retained provisionals as well as the pontic of 15 were designed and fabricated to shape the soft tissues for optimal support and (Figs. 13-15).

Following removal of the temporary bridge, all the abutments were cleaned and the tooth 15 was extracted (Fig. 16). The provisional implant restorations, fabricated with direct screw access were torqued to the manufacturer's recommendation. All other temporary printed restorations were cemented with FujiTemp (GC) (Figs. 17-19).

The soft tissues were prosthetically shaped and allowed to heal for a period of 3 months before the finalisation of the rehabilitation with the definitive restorations.



Fig. 15: Completed provisionals fitted onto the printed models to allow the refinement of the contact points and occlusal contacts.



Fig. 16: (a) After removal of the temporary bridge from the first provisionalization phase. (b) Tooth 15 was extracted.





Fig. 17: (a) Healing abutments were removed and (b) the second set of temporary restorations was placed.

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Fig. 18: Periapical radiographs to verify the seat of the implant-retained provisional restorations.

Conclusion

The case presented illustrates how advances in digital technologies can provide clinicians with the tools for diagnosis, treatment planning, the execution and provision of dental restorative procedures in a truly transformative way.

Simplification of clinical protocols, increased accuracy over conventional analogue techniques and improved patient comfort and outcomes are compelling reasons of the benefits of a full digital workflow in the field of restorative and implant dentistry.



Fig. 19: Immediate post-operative view of the inserted provisionals.



MDT Lisa Johnson from VIVID Dental Laboratory in Leeds is one of the UK's top aesthetic technicians with twenty years' of experience using composite systems and specialised in large implant frameworks. Lisa was involved with the development of the new GC GRADIA® PLUS composite resin C&B system since the early trials. Lisa has layered many frameworks using injectable techniques with the GC GRADIA® PLUS One Body System.



MDT Marijo Rezo became a dental technician in 1996 in Zagreb, Croatia. Since then, he has worked in several private laboratories in Zagreb. Since 2004, he has is own dental lab, Kati Dental d.o.o. He actively participated in various congresses and has given many workshops in the country and abroad.



CDT Jonas Spaenhoven is Product Manager at GC Europe.



MDT Roeland De Paepe is Product Manager and Demonstrator at GC Benelux.

The composite injection injection technique with GRADIA PLUS

Interview with

MDT Lisa Johnson, United Kingdom MDT Marijo Rezo, Croatia CDT Jonas Spaenhoven from GC Europe MDT Roeland De Paepe from GC Benelux

Using the proper composite, the injection technique

is a very convenient approach to get a convincing, aesthetic result with minimum effort. We spoke with four dental technicians about their experiences with GRADIA PLUS in using this technique.

The composite injection technique with GRADIA PLUS

How would you explain the injection technique?

Jonas Spaenhoven: The injection technique follows a clear procedure, with maximum control over each step. It basically consists of duplicating a wax-up by making a transparent mould. A flowable composite is injected into this mould and light-cured. This versatile technique can be used for very basic restorations - e.g. using only a dentine and an enamel composite as well as very complicated and highly aesthetic restorations. Because the injection technique allows the technician to have control over each step, it's very easy to learn allowing even young, inexperienced technicians to have very aesthetical end-results.

And besides indirect restorations, a similar approach can be used for direct restorations. GC has introduced a special injection moulding kit for this purpose.

Lisa Johnson: The injection technique is a simple way of producing composite restorations especially when you want to create an accurate reproduction. Not just wax-ups, but also temporaries, denture try-ins or the existing dentition can be copied.

What are the main advantages of this technique?

Marijo Rezo: The main advantage of the injection technique is the speed of production of the final workpiece, the high precision of this reproduction in the flask and the simplicity of the process itself.

Lisa Johnson: The process is quick, simple and extremely accurate, giving predictable results. Technicians who have minimal ceramic or layering experience can effectively produce natural looking restorations.

Jonas Spaenhoven: It also fits perfectly in a digital workflow: the wax-up can be digitally designed and milled or printed. A temporary restoration can also be printed from GC Temp PRINT and characterised with OPTIGLAZE color. This way the end result is visualised in an early stage and adaptations can still be made during this entire phase. When the patient is satisfied, the shape can exactly be reproduced with the injection technique, making it very predictable.

Moreover, composites are ideal for intra-oral corrections, small adjustments or even repairs.

What are the indications for the injection technique?

Lisa Johnson: Whether you want to reproduce a try-in, a temporary or convert a wax-up to a final bridge - the injection technique is ideal. It can also be used to repair to existing restorations.

Jonas Spaenhoven: Cases where there is a high demand for predictability are very much indicated.

Also, whenever there is a high risk of chipping, ceramics would be less suitable. Composite restorations with the injection technique are then more indicated.

Roeland De Paepe: Absolutely, because the nano-filled composite is an excellent stress absorber. In this regard, for me, the main indication is full-arch implant work because the gain of time is huge.





The composite injection technique with GRADIA PLUS

Marijo Rezo: I would also use it mostly for major implant reconstructions and telescope work. But glass-fibresupported bridges, provisional crowns and bridges and all normal indications for indirect composite are also possible.

Why is GRADIA PLUS the preferred composite for this technique?

Lisa Johnson: I choose to use GRADIA PLUS as I feel this material gives me the best possible aesthetic results – and the Light Body flowable composite is perfect for this technique. The material is strong and very easy to work with. Having used many other composite systems over the years, GRADIA PLUS is my choice for any composite work.

Marijo Rezo: The consistency of the material itself is excellent. The One body material is extremely lightly injected into the flask itself because it is very fluid and does not need to be heated.

Jonas Spaenhoven: As the injection technique is ideal for the easy reproduction of complete arches, you need a strong and wear resistant composite. With a flexural strength of 160 MPa, GRADIA PLUS is particularly suitable for high-wear, high-pressure restorations. And because you inject a big volume of highly filled composite, you obtain a very dense and strong arch.

Besides the outstanding physical properties, GC GRADIA PLUS is also very friendly to the antagonists because of the ultra-fine filler technology. Roeland De Paepe: GRADIA PLUS offers different modules were especially the LB One Body colors and the LB colors form the Layer Pro set have the perfect solutions for injection techniques.

The Gum set makes the picture complete.

Jonas Spaenhoven: There are also the Lustre Paints that can be used to paint your aesthetics externally or used internally . For very aesthetical restorations, a cut-back with internal characterisations using the Lustre Paints or Light Body effects can be performed. A variety of enamel shades can then be injected to cover the dentine base.

Thanks to the modularity of the GC GRADIA PLUS system, every technician can choose his level of finishing, depending on the case!

What makes GRADIA PLUS so different from other composite systems on the market?

Marijo Rezo: It offers a wide range of colours that can handle even the most demanding aesthetic reconstructions, and an innovative glazing system is put at the top of the range.

Roeland De Paepe: In the GRADIA PLUS system every lab can choose which modules are interesting for the preferred composite indications.

The number of syringes was brought back from 150 in the old GRADIA system to 65 in the new GRADIA PLUS.



Jonas Spaenhoven: Yes, but the colours can be mixed to obtain an individualised effect, so you have endless combination options.

Especially dental technicians who are used to working with ceramics, will immediately like this system because mixing colours is basically what they do in their daily work.

Lisa Johnson: I think this kit differs from others as it is the first kit I've found that contains everything you need to fabricate natural looking restorations, from the heavy body material that can be hand-layered to the light body that can be injected. The range of pink composites for the gingiva can also be either layered or injected. The kit also has Lustre Paints and a glazing fluid that can be used for characterisation - it's a complete kit and all you need!!



Dr. Angel Andonovski became a dental technician in 2012. In 2017, he graduated as a dentist at the University of St. Kiril and Metodij in Skopje, Macedonia. Thereafter, he started his 'Master in Prosthetic Dentistry' at the same university. In 2018, he received his license for general dentistry. That same year, he won the second price in the post-graduate category of the Essentia Academic Exellence Contest. Since 2012, he has been working as a dental technician and since 2018, he is working in one of the biggest dental clinics in Macedonia.

Injection moulding for a predictable **aesthetic outcome**.

By Dr. Angel Andonovski, North Macedonia

Extensive treatment planning can be time-consuming. However, this time is often saved at the actual execution of the treatment plan. Meanwhile, the aesthetic outcome will be more predictable and the total procedure is less stressful, as part of the treatment can be done outside the mouth, in absence of the patient.

A 35-year-old woman consulted the practice because she was dissatisfied with the appearance of her frontal teeth. At the clinical assessment old restorations with marginal discolouration, a devitalised, darkened tooth #11 with a noticeable crack on the incisal surface and rotations of the lateral incisors and right canine were found. (Fig. 1).



Figure 1: Pre-operative intraoral view. Old restorations, cracks and discolourations are visible

Injection moulding for a predictable aesthetic outcome.



Figure 2: After internal bleaching of tooth #11





aesthetic result and is cost- and

time-effective. G-ænial Universal

Injectable has excellent physical

for the long-term outcome.

properties and wear resistance: these

are important properties to consider

After internal bleaching of tooth #11

with sodium perborate, the tooth

shade was similar to the adjacent



.....

Figure 3: After removal of the old restorations

Treatment options were discussed including the need for shape correction as well as slight colour adjustments. The patient refused the use of ceramics because of the treatment cost.

It was decided to treat the teeth with G-ænial Universal Injectable composite veneers using an injection moulding technique: it renders a predictable



Figure 4: Smile after replacement of the old restorations



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Figure 6: Transparent mould from EXACLEAR



Figure 5: Wax-up of the frontal teeth



Figure 7: Creation of the injection channels with the tip of the syringe

teeth (Fig. 2). In the next session, the old restorations were replaced; simultaneously, the shape of the rotated teeth was corrected to achieve an ideal integration of the future veneers, which then could be made of uniform thickness with a predictable result (Figs. 3 and 4). Essentia Dark Dentin and Medium Enamel were used. Thereafter, impressions were made. A wax-up was prepared on the model (Fig. 5). This allows to focus on proper shape and symmetry outside the mouth, which is always more practical. It also gives an indication of how thick the applied composite layer will be; in this case, only a thin enamel replacement layer was needed. As an additional benefit, the patient needs to spend less time in the dental chair. Based on this wax-up, a transparent silicone key was prepared with EXACLEAR (Fig. 6). Injection channels were created (Fig. 7), ending at the incisal edge, so the sprue could be easily removed without altering the shape of the restoration.

Injection moulding for a predictable aesthetic outcome.





Figure 8: Frontal teeth were cleaned and slightly roughened

Figure 9: Frontal teeth were etched with phosphoric acid



Figure 10: Frosty appearance of the teeth after etching

The day after the first treatment session, the patient returned. The teeth were cleaned and the frontal teeth in need of restoration were slightly roughened (Fig. 8). Next, they were etched with



Figure 11: Teflon tape was applied on the adjacent teeth

phosphoric acid (Fig. 9), leaving the typical frosty surface (Fig. 10). One by one, the teeth were isolated by separating them from the adjacent teeth using Teflon tape (Fig. 11).



Figure 12: a) Bonding with G-Premio BOND; b) Injection of G-ænial Universal Injectable (Shade A2); c) Light-curing through the EXACLEAR mould d) After removal of the mould. Excess could be easily removed.

G-Premio BOND was applied, left undisturbed and then strongly air-blown before polymerisation (Fig. 12a). The silicone key was seated into the mouth and G-ænial Universal Injectable (shade A2) was injected (Fig. 12b) and light-cured through it (Fig. 12c). After removing the silicone key (Fig. 12d), composite excesses could be easily removed with a sharp blade.

Injection moulding for a predictable aesthetic outcome.



Figure 13: Intraoral view before polishing

The EXACLEAR impression is very precise, so all the texture that was being put in the wax-up could be replicated in the final restorations (Fig. 13). The finishing procedure is simplified in this technique; since shape and texture are already established and there is no sticky oxygen inhibition layer. All that was needed was some polishing with a goat hair wheel and a felt wheel with DiaPolisher Paste (Fig. 14). The results were predictable (Fig. 15), corresponding to the wax-up model and the rotations and colour differences were corrected. The smile line gently followed the lower lip line and a good aesthetic result was obtained.



Figure 14: Polishing with soft brushes

Figure 15: After treatment. a) Intraoral view; b) Smile



Dr. Pierre Dimitrov graduated from the Medical University of Sofia (Bulgaria), Faculty of Dental Medicine in 2016. He is working in the dental clinic DentaConsult in Sofia. His interests are in restorative dentistry of posterior teeth, endodontics, digital dentistry and dental technology. Dr. Dimitrov has attended postgraduate courses in the fields of e.g. composite restorations, indirect ceramic restorations, endodontic treatment and digital workflow in restorative dentistry.



Dr Assen Marinov graduated from the Medical University of Sofia (Bulgaria), Faculty of Dental Medicine. He is practicing in the fields of dental implantology, functional and aesthetic dentistry. Dr. Marinov has finished the Basic Curriculum at the Vienna Interdisciplinary School of Dentistry (VieSID) (Austria), implementing the protocol of Prof. Rudolf Slavicek in his practice. He also finished the complete course in functional diagnostic wax-up of DTG Stephan Provancher and attended the Master Program in digital and aesthetic dentistry with Paulo Kano." Together with the team of DentaConsult, Dr. Marinov is developing a growing practice in Sofia. He is combining digital and analogue workflow in treatment planning and execution.



MDT Boyanka Vladimirova became a dental technician in 1994. She got her training and Dental Council's registration at the Medical Collage in Varna (Bulgaria). She is a member of the Dental Technologists Association (DTA). She has been working at various laboratories and owns her own company since the beginning of 2018. She is also a ceramist at the team of DentaConsult. Her focus is on aesthetic crowns and bridges, with a strong attention to design, detail and quality.

Indirect Hybrid Nano-Ceramic Adhesive Restorations in the Posterior Region

A case report using the new CERASMART270

By **Dr. Pierre Dimitrov**, **Dr. Assen Marinov** and **MDT Boyanka Vladimirova**, Bulgaria

Indirect composite and ceramic restorations are a valid solution in restoring medium to heavily damaged teeth in the posterior region, providing strength, longevity and aesthetics. With the advancement of CAD/CAM technologies and intraoral scanners we can produce and deliver these kinds of restorations in one visit or a few days, minimising the chance of sensitivity, maintaining tooth vitality and protecting the damaged tooth structures from cracks and fractures. Using contemporary adhesive systems and composite materials we are able to bond indirect restorations with little to no retention in the preparation, without unnecessary sacrifice of tooth structures and still be able to guarantee a predictable long term success to our patients.



Fig. 1: CERASMART270 overlay, milled with Sirona Cerec 4.

The new CERASMART270 is a great addition to GC's growing CAD/CAM solutions providing increased strength while keeping everything great about the original CERASMART blocks - flexibility, possibility of abrasion and repairability at a reasonable price (Fig. 1). Our preparation, production and luting procedures remain basically the same without the need to change or adapt our clinical and laboratory protocols. The CERASMART270 blocks are a perfect choice for in-office milled indirect restorations as the finishing, staining and glazing steps can be easily carried out in the dental office using GC OPTIGLAZE and OPTIGLAZE color.

I would like to share a case from our daily practice, restoring three posterior teeth in a quadrant where CERASMART270 blocks in two translucencies were used - A3 HT for the molars and A3 LT for the endodontically treated, darker shaded



Fig. 2: Preoperative photograph, occlusal view.

premolar. A mixed analog-digital workflow was used for this case. The treatment was completed in two visits in the span of 3 days. Each step from the preoperative situation until the finishing, including the laboratory phase will be shortly explained.

The patient initially presented with a few direct restorations in the left lower jaw (3rd quadrant) (Fig. 2). Complaints of the patient were increased sensitivity to thermal stimuli in this region and food impaction. The second premolar was endodontically treated and without radiologic or symptomatic signs of apical periodontitis; the buccal and lingual walls and the mesial marginal ridge were thin and undermined; the shade of the tooth was visibly different. The first molar was vital with a big direct composite restoration of the mesial, occlusal and distal surfaces with residual caries on the distal; the buccal and lingual wall were thin and suspected to crack or fracture at any time. The second molar was vital with a faulty direct restoration, showing degradation of the bond between restorative material and tooth, uncovered dentine, suboptimal proximal contacts and thing buccal and lingual walls. The soft tissues were inflamed. The decided treatment plan with consent of the patient was to restore the second



Fig. 3: Intraoperative view - restoration and caries removal, cusp reduction.

premolar and two molars with full coverage CERASMART270 overlays in 2 visits - one for preparation and impressions and another one for bonding the restorations.

After isolation with rubber dam, the old restorations and underlying caries were removed with a round diamond bur on high speed with plenty of water cooling, followed by final cleaning of the decayed dentine with a steel manual excavator and gentle sandblasting with 27 micron aluminum oxide particles. A small portion of the mesiolingual pulp horn was exposed. The undermined and unsupported cusps and walls were reduced to ensure stable dentinal support of the tooth structures and provide restorative material space of 1.5 - 2mm. A buccal chamfer preparation was chosen for the second premolar out of aesthetic considerations. (Fig. 3)

An immediate dentine sealing procedure was carried out to ensure optimal adhesion to the freshly prepared dentine and to create a hermetically sealed biological system, protecting the tooth structures from contamination. A deep margin elevation was performed for the distal margin of the second premolar. Enamel margins were left uncovered to be available as an adhesion substrate in the cementation







Fig. 4: Immediate dentine sealing and deep margin elevation.

Fig. 5: Stone models mounted in the articulator.



Fig. 6: Digital design of the restorations.

step. The pulp exposure was only sealed using adhesive and flowable composite.

The tooth structures were gently sandblasted for 10-15 seconds with 27 micron aluminum oxide particles under pressure with plenty of water cooling. Dentine was then etched with 37% phosphoric acid for 15 seconds and generously rinsed afterwards, followed by gentle drying of the dentinal structure with a 3-in-1 syringe to prevent desiccation of the tooth structures. With a microbrush, a coating of G-Premio BOND was applied and rubbed for 20 seconds onto the dentine. After thinning of the adhesive with air it was cured for 20 seconds using the High Power Mode of D-Light Pro. A layer of G-ænial Universal Injectable, shade A2, was applied over the dentine, sealing it and removing all uneven surfaces and undercuts of the preparation. With a diamond bur the enamel margins were prepared once again to ensure to adhesive or composite has been left. Preparation and marginal finishing were done after the removal of the rubber dam. (Fig 4) A one-step VPS impression of the lower jaw, an alginate impression of the upper jaw, a bite registration and a face bow were transferred from the patient to the laboratory. In the lab, stone models were fabricated from GC FujiRock. The models of the jaws were mounted in a semi-adjustable articulator using average settings using the bite registration and the face bow. The preparation model was cut into separate stone dies for optimal scanning and access to the margins. A check model of the prepared teeth was also poured from GC FujiRock. (Fig. 5)

The models and the separate preparation dies were scanned using Medit Identica T500 laboratory scanner. The restorations were then designed in ExoCAD according to the static occlusion and the dynamic relationship of the teeth in protrusion and lateral movements using the virtual articulator function. (Fig. 6)

The restorations were milled from CERASMART270 with a Roland DWX-4W milling machine using a milling strategy for hybrid ceramics. The second premolar restoration was milled from CERASMART270 A2 LT and the two molars were milled from CERASMART270 A2 HT. (Fig. 7)



Fig. 7: Milled restorations straight from the milling machine.

The restorations were cut from the sprues, finished with a rubber point, sandblasted with 27 micron aluminum oxide and cleaned with a steam cleaner. A coating of CERAMIC PRIMER II was applied and was set to dry. Characterization was done using OPTIGLAZE color and OPTIGLAZE Clear. Each layer of the stains was polymerised for 20 seconds using D-Light Pro in High Power Mode. The restorations were finally polished with diamond paste and a goat-hair brush. (Fig. 8)

On the day of the cementation, the restorations' inner surfaces were sandblasted with 27 micron aliminum oxide particles and subsequently cleaned using phosphoric acid for 30 seconds. With a microbrush, a coating of CERAMIC PRIMER II was applied to the clean surface and let to evaporate. G-ænial Universal Injectable A2 was used as the cementing composite. It was applied right before the cementation (Fig. 9).

The preparations were isolated with a rubber dam and were sandblasted with 27 micron aluminum oxide particles under pressure with plenty of water cooling in order to achieve a clean and rough surface, ensuring



Fig. 10: Isolated and sandblasted preparations, prepared for adhesive cementation.



Fig. 8: The finished restorations on the check model.



Fig. 9: Inner surface treatment before adhesive cementation of the restorations.

optimal adhesion between the restorations and the teeth. (Fig. 10)

The cementation of the restorations was carried out one by one for each tooth following the same protocol for treating the tooth surface. Enamel and composite were etched with 37% phosphoric acid for 30 seconds, followed by generous rinsing with water. The preparation surface was air dried with air. G-Premio BOND was



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applied to the preparation surfaces in accordance with the manufacturer's instructions.The restoration was put and held in place by hand. All composite excess was removed using a probe and a brush until visual control of the sealed preparation's margins was achieved. Everything was polymerised after complete cleaning on each surface of the tooth (buccal, lingual and occlusal) for 20 seconds on each surface with D-Light Pro in High Power Mode. (Fig. 11)



Fig. 12: Final view of the cemented restorations after rubber dam removal, inspection for excess cement with D-Light Pro in DT Mode.

Finishing and polishing of the margins of the restorations was done using abrasive metal and polishing plastic strips, rubber points and a polishing brush with diamond paste. Using the Detection Mode of GC's D-Light Pro we were able to inspect the margins of the restoration and tooth structures for excess cement. A good overall integrity of the tooth-restoration complex was achieved. (Fig. 12)

A bitewing radiograph of the cemented overlays was taken in order to assure proper restoration adaptation and visualise composite excess. The small excess of composite viewed at the distal margin of the second molar was removed subsequently and the margin was polished using rubber points and polishing brush. (Fig. 13) A checkup of the restorations 2 months after cementation showed good aesthetic and functional integration. The patient was comfortable and satisfied with the treatment. No complains of sensitivity, food impaction or any discomfort have been reported. The restorations displayed a pleasant aesthetic integration, including the second premolar which had a significantly darker shade before the treatment. (Fig. 14)

In conclusion, the new CERASMART270 is a great addition to GC's CAD/CAM solutions. Compared to its original predecessor, it offers increased strength, while maintaining flexibility, simplified laboratory steps and maintaining the same clinical protocols in preparation and cementation procedures. Thanks to the great line and wide selection of GC's restorative materials - flexible and simplified adhesive systems, different kinds of clinical and laboratory composite materials, highly aesthetic and durable ceramics and other equipment, we are confident to offer our patients a long term solution and provide them with functional and aesthetic restorations with a minimised risk of procedural mistakes and complications.



Fig. 13: Bitewing radiograph after cementation of the CERASMART270 restorations



Fig. 14: Two months recall of the cemented CERASMART270 restorations.

Prof. Joseph Sabbagh graduated from Saint-Joseph University in Beirut (Lebanon) and in 2004, he obtained his PhD in Biomaterials at the Catholic University of Louvain (UCL), Belgium. In 2000 he obtained a Master in Operative Dentistry (Restorative dentistry and Endodontics) at UCL. Currently, he is an associate Professor at the Department of Restorative and Aesthetic dentistry in the Lebanese university and the director of the Master program as well as guiding several research projects. His private practice is restricted to aesthetic dentistry and endodontics.

He has published many papers in international peer-reviewed dental journals and has lectured locally and internationally. He is a member of the Academy of Operative Dentistry USA, the editorial board of Reality-Journal, USA, the International Association of Dental Research, and a fellow of the International College of Dentists.

Smile rehabilitation with lithium disilicate veneers: a case report

There is an increasing demand of patients for a beautiful smile, combining perfect teeth alignment to a natural shade. Different materials and techniques are available on the market, but in terms of longevity and patient satisfaction, the results are not similar. When compared to indirect porcelain veneers, direct composite veneers, and prefabricated veneers, showed a lower survival rate, with several shortcomings and high risk failures such as veneers debonding and overcontouring¹.

Porcelain laminate veneers made with lithium disilicate remain the gold standard technique in terms of longevity and survival rate². The main advantages of pressed porcelain are that the resulting veneers have a high level of accuracy and minimal internal structural defects³.

By Prof. Joseph Sabbagh, Lebanon

The following paper reports the case of Serena, a 25-year-old patient that complains about her unpleasing smile due to wear and erosions on the upper laterals and incisors (Fig. 1). After a thorough clinical examination and smile analysis, in order to optimise the result, it was agreed to place four laminate veneers made with lithium disilicate (Initial LiSi Press, GC).



Fig. 1: Preoperative view of the patient smile (upper anterior teeth)

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Smile rehabilitation with lithium disilicate veneers: a case report

An alginate impression was taken, and a diagnostic wax up was made on the four anterior teeth (Fig. 2). A silicone tray was made on the wax-up using Exafast (GC), a polyvinyl siloxane (PVS) and left during three minutes for setting. Then the mock up was made using Tempsmart DC (Shade A1), a dual-cure resin based composite (Fig. 3).

In the following session, the teeth were minimally prepared using diamond burs from the SKIV Kit (Simple Kit for Inlay and Veneers, Komet, Fig. 4) ensuring finishing contour within enamel with equi-



Fig. 4: Simple Kit for Inlay and Veneers, for veneers preparation



Fig. 2: Wax up of the four upper incisors

gingival limits (Fig. 4a). The preparation phase consisted of three steps : buccal, incisal and proximal reduction. The incisal preparation was carried over the incisal edge from buccal to palatal, with an incisal reduction of



Fig. 4a: Minimal teeth preparation for Porcelain Laminate Veneers : buccal view

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Fig. 3: Mock up on the upper incisors made using Tempsmart DC (A1)

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1.5-2 mm. Palatally, the teeth were finished with an overlap, for a better seating of the veneers (Fig. 4b), and an enhanced translucency of the incisal edge⁴.



Fig. 4b: Palatal view of the prepared teeth



Fig. 5a: Lithium disilicate veneers (Initial LiSi Press)

The second session was dedicated to veneers placement. After removal of the temporaries and cleaning of the teeth, the four veneers received from the laboratory were tried in (Fig. 5a). For an optimal adhesive procedure, the working field was isolated using a



Fig. 5b: Application of hydrofluoric acid (9%) during 20 sec

rubber dam, and ligatures were made around the teeth with waxed dental floss, to avoid any gingival fluid contamination.

The inner parts of the veneers were prepared as follows; sandblasting using alumina oxide, (usually carried out by



Fig. 5c: Application of silane (Ceramic Primer II) during 2 min

the lab), then conditioning using hydrofluoric acid (9%) for 20 seconds (Fig. 5b), then thorough rinsing, and finally a layer of silane, the Ceramic Primer II, was applied and left undisturbed for 2 minutes (Fig. 5c), than dried to remove any existing excess.

Smile rehabilitation with lithium disilicate veneers: a case report

Teeth preparation consisted of etching all the surfaces with orthophosphoric acid with a concentration of 37% during 20 seconds (Fig. 6a). Then, the



Fig. 6a: Application of orthophosphoric acid 37% during 20s on the prepared teeth

After applying G-CEM Veneer cement at the inner side of the porcelain restorations, the two centrals were seated first (Fig. 7), then the two laterals. Excesses of cement were removed using a brush, then tackcured for 3 seconds out using a LED unit, and interproximal excess were

Light-curing resin cements are preferred for veneers cementation as they have a longer working time, allowing the placement of several veneers. The setting time is controlled by the operator. Additionally, G-CEM Veneer cement has an optimal consistency that avoids excess displacement in the interproximal areas, making their removal much easier. The final polymerisation is achieved through a layer of glycerin gel placed on all the veneers, in order to avoid the formation of an oxygen inhibited layer (Fig. 8).

The occlusion was carefully checked using articulating paper in centric

teeth were thoroughly rinsed and gently dried, and the universal adhesive G-Premio BOND (GC) was applied with a microbrush (Fig. 6b), gently



Fig. 6b: Application of G-Premio Bond adhesive

gently removed using dental floss. Polymerisation was completed during 40 seconds from each side using the same light-curing unit. Careful removal of excesses reduces the finishing procedure and ensures a better finishing and polishing of the porcelain veneers. dried and air thinned, then polymerised for 20 seconds (Fig. 6c).



Fig. 6c: Light curing of the bonding during 20 sec



Fig. 7: Application of the G-Cem Veneer (Translucent shade)



Fig. 8: After veneers placement, a layer of glycerin is applied for a better polymerisation.

occlusion followed by excursive and laterality movements. Rugby-shaped fine diamonds were used with water spray to adjust the occlusion; then rubber points were used to polish the surfaces.



Fig. 9: Silicone point used for final polishing

The use of diamond burs on the buccal surface of the veneers, is not recommended, in order to preserve the surface gloss. Buccal excesses can be removed using a blade N° 12. A silicone cup was used for polishing (Fig. 9)

Smile rehabilitation with lithium disilicate veneers: a case report

and finally a small quantity of diamond paste was used on a low speed for the final lustre and polishing using a goat brush wheel.

Figures 10 a and b show the postoperative buccal and palatal views of the veneers 6 months after their placement in the mouth.



Porcelain laminate veneers are considered a very conservative technique in aesthetic dentistry. Their longevity depends on many factors that can be summarised into a careful case selection, a healthy gingival tissue and periodontal environment and an excellent laboratory. When those criteria are



respected, the survival rate of porcelain laminate veneers at 15 years, is close to 85%⁶. Layton and Walton reported the longevity of feldspathic porcelain veneers as up to 12 years; at 5 years, the survival rate was 96%, dropping to 93% at 10 years and to 91% at 12 years⁷ (Layton and Walton, 2007).

Fig. 10a and 10b: Postoperative buccal and palatal views of the veneers after 6 months

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Dr. Marcus Holzmeier worked as a freelance dentist from 1999-2000 after his studies at the University of Erlangen. During his time as a product manager and clinical research associate at Heraeus Kulzer (2000-2004), he obtained his doctorate at the University of Mainz in 2002. Prior to obtaining the recognition as a specialist in orthodontics in 2007, he worked as a research assistant at the University of Erlangen from 2004-2007. Since 2007, he has been working as an orthodontist in the practice of Dr. Windsheimer & Partner in Crailsheim. He specialises in early treatment, functional orthodontics as well as adhesive technology. Parallel to his work in the practice, Dr. Holzmeier regularly works as an author and speaker and has been a lecturer at the Department of Orthodontics at the University of Würzburg since 2008. He is a member of the WFO and DGKFO.

Experiences gained with Experience™ mini Rhodium and Ortho Connect:

A Self-ligating bracket with a compelling design and convincing implementation process

By Dr. Marcus Holzmeier, Germany

Self-ligating brackets are an integral part of modern orthodontics, as they are associated with significantly shorter treatment times than conventional brackets among other things. In practice, the various systems do indeed have quite different handling characteristics, so that the changeover to another or new system is associated with a period of familiarisation. If this is facilitated by training and if a new system convinces by its clinical handling, efficiency and aesthetics, the decision to change products is worthwhile. Dr. Marcus Holzmeier is convinced of this. In this context, he reports on his positive experiences in using the self-ligating Experience™ mini Rhodium bracket (GC Orthodontics) on the basis of a case study. Bracket systems are usually indicated in modern orthodontics as soon as complex, physical tooth movements have to be made, e.g. in the case of pronounced rotations, displacements or gap closure or gap opening.¹ Usually, a lack of oral hygiene or the express wish of the patient not to use fixed appliances are arguments against a fixed treatment method. In this case, other solutions need to be found. Once the indication for bracket treatment has been established, this can be performed with a variety of different systems and the appropriate specialist knowledge. In general, it is essential to know "one's" system used in practice, its values and behaviour during tooth movements. We prefer using selfligating brackets in our practice, as there is less friction from the beginning of the levelling phase. As a result, tooth movements are executed with minimal forces, which increases the patient's wearing comfort due to reduced pain and simultaneously moves the teeth quickly and effectively – the treatment time can therefore often be shortened. In addition, the absence of elastics reduces plaque retention around the brackets and makes it easier to clean the patient's teeth.²

As long-time users of self-ligating brackets, we had already been looking for a better alternative to our used system for several years and have tested different self-ligating bracket systems during this time. It was important to us to find a bracket suitable for the MBT. 022" slot system generally used in the practice and to be able to work conceptually in one system. On one hand, the new bracket should not differ too much from the previous system in terms of handling in order to keep the familiarisation time for the team as short as possible, and on the other hand, the points that had previously led to irritation had to be solved better by the new bracket.

I also need an aesthetically pleasing, relatively small bracket in order to meet the patients' demands. This basic requirement is fulfilled by the Experience mini Rhodium (GC Orthodontics), which we have been using successfully since autumn 2016 in all new cases with self-ligating brackets. In our opinion, other requirements for a bracket include an as flat as possible profile, e.g. to avoid interfering with the occlusion in case of deep bites and without affecting the patient's cheeks and lips if possible. The bracket should have a sufficient mesio-distal width to provide good guidance and rotation control. The surface must allow the best possible sliding movement, i.e. friction, binding and notching effects should be as small as possible in the area influenced by the bracket material per se. We also place great emphasis on a sturdy clip that can be opened and closed easily and a bracket, the base of which provides a secure bond. It is annoying if the closure clip breaks or "wears out" during treatment and can no longer retain the archwire in the slot. Equally advantageous is the overall small size of the bracket, which despite its miniaturisation integrates wings in order to be able to place a ligature or attach rubber chains if required. We chose Experience mini Rhodium, as it meets all the clinical requirements here. In addition, it benefits from

improved aesthetics compared to the predecessor bracket we used and can also be employed as a passive or active system, depending on the size of the archwire and deflection.

Experiences

The carefully considered switch to Experience mini Rhodium has proven its value. We have no more fractures of the closure clip and hardly any detached brackets: Due to the low depth, contact with the front of the lower jaw is rare and the micro-etched mesh pad base of the bracket appears to produce excellent bonding to the composite (in our case Transbond XT (3M Unitek) or Ortho Connect (GC Orthodontics)).

As is generally known, orthodontics tend to be more of a long-term treatment, and therefore it is not possible to completely replace a predecessor product at a fixed point in time; rather, it is a matter of phasing out and introducing bracket types. Since the introduction of Experience mini Rhodium into our practice, all new patients receive these as selfligating brackets and all previously started treatments are completed with the predecessor product. As a result, we worked with both bracket types over a transitional period of approx. 2 years. In view of this additional logistical effort and the constant mental change between the systems, it is understandable that it was not an easy decision to switch to another bracket. Rather, this decision was preceded by collecting extensive information and discussions with colleagues.

The changeover was facilitated by a team training course conducted by one of the manufacturer's employees in our practice at the time the bracket was introduced. The team learned how to handle the new bracket in its original size as well as on an oversized demonstration model and how to open, close, etc. using a typodont. From the outset, we therefore avoided any anxieties with regard to the new system or faulty handling when changing archwires. The assistants appreciate the reduced effort required for clips compared to ligatures. Derotation, particularly in the initial phase, works excellently due to the bracket width (rotation control) and the secure hold of the closed clip.

In combination with GC Ortho Connect, the practice also benefits from the easy application of the system for bracket bonding: This one-component system does not require bonding, so that the bracket can be placed directly on the etched and dried enamel surface after application of GC Ortho Connect. Dosage of the correct amount is quickly practiced and works well. In addition, I also enjoy working with GC Ortho Connect because the brackets– despite the low viscosity of Ortho Connect, which allows penetration into the etched enamel profile – remain in a stable position before polymerisation and excess material is easy to be removed. To date, the material has demonstrated high adhesive strength, which is clinically comparable to the orthodontic gold standard Transbond XT (etching gel/ primer/composite), which is also used in the practice.

We appreciate the option that the brackets can be ordered both individually or in pre-sorted trays per case. Another big advantage is the option of choosing between open and closed brackets. We prefer the open bracket as this allows good position control with the height gauge (see Fig. 13 further on) as well as alignment with the Heidemann spatula (see Fig. 11 further on). All brackets for the posterior region can be supplied with hooks so that we are flexible when placing elastic bands. The brackets in our

practice are usually combined with the aesthetic Initialloy RC and BioActive RC (GC Orthodontics) archwires. In our experience, a defined break occurs between the base and the composite material during removal of the bracket, so that the composite residues can be polished from the tooth surface as usual. We have not observed any chipping of enamel during removal to date. Overall, we like using self-ligating brackets and in particular Experience™ mini Rhodium, as they make work considerably easier, for example, when opening and closing with the EM instrument, they accelerate some treatment steps (especially in the levelling phase at the beginning of the treatment) and are comfortable to wear and clean for the patient. In addition, the teeth move quickly and effectively due to the lower friction compared to conventional brackets, i.e. the total treatment time can often be reduced.³ Furthermore, the Experience mini Rhodium is bevelled at the edges of the slot, so that binding effects are also reduced during translational movement.⁴

Case report

The following clinical case shows the incorporation of a multibracket appliance with self-ligating brackets. The banding of the 6's is not discussed in the following.



The then ten and a half year old patient presented herself for orthodontic treatment at the end of 2016. The extensive diagnostic measures, such as clinical examination, model analysis,



OPG, FRS and photo analysis, exhibited a skeletal class III tendency. An alveolar midline shift of 1 mm to the right was visible in the maxilla. The maxillary arch exhibited a narrowing of the gap



Figs. 1-3: Intraoral images in occlusion before the start of treatment with a fixed appliance

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in region 13 with an elevated and protruding position of tooth 13. The first quadrant showed a pre-migration of 1.5 mm. In addition, tooth 12 had a cross bite and a misaligned position of the anterior teeth (Figs. 1-5).

Treatment was initially initiated in March 2017 with plates, in the maxilla with protrusion segment from 12-22. This enabled us to use the phase of second dentition and protrude the maxillary front by about 5 degrees. The aim of the multi-bracket phase, which followed six and a half months later, is to adjust the teeth physically: rotation, tip and torque are precisely controlled and adjusted; the correction of the cross bite is performed including the correctly adjusted oral-vestibular root inclination. With the aid of the self-ligating brackets to be inserted, tooth 13 is quickly guided to the occlusal plane with as little friction as possible and thus accelerated movement, while at the same time being moved into a distally neutral position. Teeth 16 and 26 should be held in position.

An alternative would have been orthodontic treatment using removable appliances exclusively. However, plate apparatuses would have made it difficult to adjust both tooth 13 and physically shift tooth 12, as well as the correct adjustment of tip and torque. A further therapy option might have been an aligner treatment, whereby the treatment would have required at least one case refinement due to the not yet present teeth 15 and 25. In addition, 100% compliance is a prerequisite here for achieving difficult extrusion movements with aligners, such as those required for tooth 13.



Figs. 4-5: Narrow positions and misaligned teeth

Due to this fact and also for reasons of cost, this alternative was excluded, as aligner treatment is to be paid for in full privately. After informing about the various treatment options, we therefore decided together with the patient and her mother to opt for multibracket treatment with the self-ligating Experience mini Rhodium brackets, based on the above-mentioned advantages of the system. Initially, the teeth were cleaned



Fig. 6: Etching of the tooth enamel with phosphoric acid gel in the area of the brackets to be bonded



Fig. 8: Experience mini Rhodium Bracket Tray opened for the patient

intensively with a fluoride-free polishing paste. Fine pumice powder is also suitable for preparatory cleaning. The tooth enamel was then conditioned for 30 seconds with 37% phosphoric acid gel (Ortho Etching Gel; GC) in the area where the bracket bases were to be bonded (Fig. 6). After spraying the gel and drying the etched tooth surfaces, the typical chalky white enamel surface was clearly visible (Fig. 7).



Fig. 7: The etched tooth surfaces impress with chalky white.



Figs. 9-10: GC Ortho Connect light-cured orthodontic adhesive applied directly to the bracket base



Fig. 11: The bracket can be aligned with the Heidemann spatula.



Fig. 12: After applying the bracket, excess composite is removed with the Heidemann spatula.

Now the brackets from the GC Tray (Fig. 8), which had previously been opened for the patient, could be clamped sequentially into the bracket forceps and the composite material applied directly from the GC Ortho Connect syringe to the bracket base by means of the attached disposable





Fig. 13: Alignment of the bracket using a height gauge



Fig. 15: The ligated archwire with closed bracket clips



Fig. 14: Light polymerisation for a total of 20 seconds per tooth



Fig. 16: Condition without colour coding after the first brushing of the teeth

according to MBT system specifications. The composite was then cured (Fig. 14) for 20 seconds (depending on the treatment room Bluephase Style; lvoclar Vivadent or SmartLite Focus; Dentsply Sirona). Here, it is important to work with as high a light output as possible (for LED devices from 1,200 mW/cm² upwards) that reaches well below the bracket base.

Finally, any excess material remaining after polymerisation must be removed using a scaler or finisher. This was followed by the application of a fluoride-releasing, light-curing sealant to the buccal and labial surfaces respectively (Pro Seal; ODS/ polymerisation for 20 seconds). Finally, the first archwire could be inserted (Fig. 15). A 0.014" nickel-titanium (NiTi) was used as archwire material, which had previously been adapted on the model and was now inserted with the Weingart forceps.

The ends of the archwire were annealed and bent. Ligating proved very easy as the brackets were already open when delivered in the tray and the EM instruments for opening and closing the brackets were included with the initial order by GC.

Alternatively, it is also possible to very easily open or close the clip with a Heidemann spatula, by placing it on the opening groove and opening the clip with a twisting movement. Finally, the brackets were closed with the EM instrument, which again, is also possible with the Heidemann spatula or with the finger. The colour coding disappeared after the first brushing of the teeth (Fig. 16).

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Fig. 17: Very fast levelling is already evident 5 weeks after insertion. This is particularly evident during the onset of alignment for tooth 13. Unfortunately, oral hygiene is inadequate at this time. Oral hygiene instructions were repeated together with giving remotivation.



Fig. 18: A further 5 weeks later: marked tooth movement has taken place.



Fig. 19: Condition after changing the arch

The very fast onset of alignment for tooth 13 (Fig. 17) was already apparent at the first change of the archwire after five weeks.

The aesthetic archwire Initialloy[™] Rhodium, Medium, Form C, 0.018" (GC Orthodontics) was now used as archwire, which, in combination with the brackets, creates a relatively inconspicuous apparatus. Unfortunately, oral hygiene was not sufficient at this time due to the naturally occurring hindrance by the brackets, so that oral hygiene instructions were repeated as well as giving renewed motivation and recommending the use of Tooth Mousse (GC). A further five weeks later, the distinct tooth movement was impressive and oral hygiene was also improved (Figs. 18 and 19).

With appropriate treatment progress, I expect a good and fast adjustment of teeth 12 and 13 as well as a correction of the midline shift in the maxilla. At this point in time, I expect to achieve neutral dentition within 12-15 months.

Conclusion

Experience mini Rhodium is a very comfortable bracket for the dentist and the patient: the markings and shape enable good positioning, the robust closing clip and the flat construction height with good width (rotation control) are convincing from the material side, as are the good MPa values for enamel adhesion in combination with GC Ortho Connect. In my opinion, another application advantage is that the handling during follow-ups and the associated change of archwires can be learned quickly by the team and implemented without errors.

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Dieter Pils (Austria) graduated as a dental technician in 1988. He passed the Instructor Examination and Entrepreneur Examination and obtained the title of 'Master dental technician' in 1995. In 2018, he obtained the 'Master of Science' degree in dental technology at the Donau Universität Krems (Austria). Since 1996, he is the CEO of Pils Zahntechnik GmbH.

Hybrid zirconia titanium abutments assembled with G-CEM LinkAce can be autoclaved maintaining structural integrity.

By MDT Dieter Pils, Austria

Implant abutments are classified as semi-critical medical devices. Regulator authorities in the EU as well as in the US therefore recommend to sterilise them after each use and possible contamination. Sterilisation is not harmful for titanium, but little information can be found regarding the effect on resin cements and ceramics. Therefore, we tested in collaboration with the Danube Private University in Austria and Uni-Saarland in Germany whether or not autoclaving could harm the structural integrity of two-piece abutments.

Hybrid zirconia titanium abutments assembled with G-CEM LinkAce can be autoclaved maintaining structural integrity.

We cemented 24 CAD/CAM-generated zirconia abutments with G-CEM LinkAce on prefabricated titanium bases. We split the abutments into two groups; one group was autoclaved and the other group remained untreated. All specimens were mechanically aged in a chewing simulator and thermocycler. Thereafter, all abutments were subjected to a pull-off test, limited to a maximum force of 1000 N, which is higher than the force reached by most cements. With this test we tried to detach the abutment from its titanium base. A high stability of the hybrid abutments was found in both groups, demonstrating high retention force. Steam autoclaving did not seem to have a weakening effect on G-CEM LinkAce; in contrast, we found a significantly higher number of specimens reaching the pre-set maximum force of 1000 N after the sterilisation process. Possibly, the heat had a similar effect as post-polymerisation methods used in the lab that also make use of heat to increase the cross-linking density of resin polymers.

G-CEM LinkAce is my preferred luting option in the lab for hybrid abutments, as it's strong, self-adhesive and can lute ceramics, zirconia, metal as well as composites. As such it has become indispensable for my daily work!

Do you want more details on how to cement hybrid abutments with G-CEM LinkAce? Take a look at this interesting article from Roland Verhoeven, published in GC get connected 3.

G-CEM LinkAce





Source: Pils D et al. Application of a standard autoclaving protocol does not harm structural integrity of two-piece zirconia abutments under detachment force testing. Clin Oral Investig. 2019 May 10. doi: 10.1007/s00784-019-02926-9.



Patric Freudenthal graduated as a dental technician in 1989 at the University of Malmö, Sweden. Before that he worked as a dental assistant between 1984-1986. After graduating, he worked as a technician for 10 years before starting his own lab with Björn Stoltz. IQDENT has worked with implants, CAD-CAM and aesthetics during all this time, with focus on bioinert materials. Since 2004, Patric has been lecturing on different topics, such as: implants, CAD-CAM, aesthetics, full ceramic etc. Function & aesthetics with technology is the key-instrument in his everyday work. He is a member (and board member) of The Dental Technicians Guild.

Zirconia: Aesthetic, strong and predictable

By **Patric Freudenthal** IQDENT / DTG, Sweden



Aesthetics and economy

When zirconia hit the dental market in the late 90's, it was expensive for the labs and clinics, and only provided by big milling-centers and companies.

The system had very few options on design and the amount of units that could be made. In the beginning, it were only single units and after a few years small bridges. Slowly it started to take over the porcelain-fused-to-metal (PFM) crowns, mostly for the improved aesthetics and ease of use. In the Nordic countries, the production costs are high (high taxes on labor and means) so the dental labs are always looking for more cost-effective ways to make their workpieces.

From the moment the prices enabled in-house milling at a lower cost, a small revolution happened in the dental labs! Now we could mill more or less everything and milling zirconia became a daily business. Soon the design software improved and we could design more freely and for more indications. Today there is almost no limitation for what a dental lab can produce in-house.

It became possible to have your own industrial production on a small scale

| Moment | PFM Time | Zirconia Time |
|---------------------------|----------|---------------|
| Model | 20 | 20 |
| Spacer | 3 | 6 |
| Applying casting channels | 2 | 0 |
| Invest | 2 | 0 |
| Prepare alloy | 5 | 0 |
| Cut casting channels | 3 | 0 |
| Adjustments | 5 | 0 |
| Polishing | 4 | 3 |
| Margins | 5 | 5 |
| Wax-up | 15 | 0 |
| Investment material | 3 | 0 |
| Burn-out | 4 | 0 |
| Devest, sandblasting etc. | 6 | 0 |
| Try-in | 3 | 1 |
| Porcelain | 40 | 40 |
| Total time | 120 | 75 |

Fig. 1: Production time comparison chart between the traditional PFM-crown and the present-day layered zirconia crown.

and by adapting the workflow and product portfolio accordingly, it became an economic business.

In our lab we have always been interested in production optimisation, how much time it takes to reach the end result, how much time a remake would take, which way would be the most cost-effective (Fig. 1)...

The difference in production time says it all! Obviously, we always have to keep the required quality and level of aesthetics in mind. Different customers may have different demands.

We believe that today, our lab has reached a good balance between the economical aspect and our production process, offering a high quality meeting all our customers' requirements.

The aesthetical veneering material should meet the production time, the quality and aesthetical outcome. After testing a wide range of materials, we ended up with the system of GC Initial. Here we found a full range of ceramic solutions. From painting solutions with GC Initial Spectrum Stains (2D) or GC Initial Lustre Pastes NF (3D), to layering solutions with GC Initial MC / Zr-FS / LiSi / Ti. This range of ceramics offered us all we needed to deliver the desired quality.

Zirconium dioxide is a strong material (some call it 'the white metal') but at the same time it is brittle, like all ceramic materials. If you don't pay attention, it is easily damaged, all it takes is a diamond disc in the wrong place.

Another important thing is the design of the framework, especially the connectors in bridges. The connector is the weakest point in a bridge framework. In a single crown, the thickness of the coping and the tooth preparation design are the most important factors.

To control all the manufacturing steps (design, milling, cleaning, colouring with infiltration liquids, sintering) is of utmost importance. Therefore, choose a qualitative zirconia and strictly follow the manufacturer's instructions during the production process. Use high quality milling machines and a sintering furnace that can go up to at least 1650° for better and more predictable results.

Zirconia: Aesthetic, strong and predictable

My recommendation would be to take your time to read through the existing literature on zirconia and all the steps needed to have control from design to sintering.

Our workflow

In our lab we have three main techniques in zirconia:

1 Layered **| 2** Semi layered - also called micro-layering or buccal veneering **| 3** Monolithic or One Body These can be either tooth-supported or implant-supported.

Below, examples of a 0.3 mm layering design (Fig. 2) and an 0.8 mm layering design (Fig. 3) are shown. Highly aesthetical results can be obtained with both techniques. The technique selection depends on the appearance of the surrounding teeth that need to be replicated. For the case shown in Fig. 3, a very translucent incisal edge needed was needed; therefore, a more traditional layering from dentine to enamel was used.



Fig. 2a: 0.3 mm layering design



Fig. 2b: The staining technique with a base of Initial Lustre Pastes NF and a sprinkle of CL-F and a second bake with Spectrum Stains.



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Fig. 3a: 0.8 mm layering design



Fig. 3b: For a 0.8 mm buccal cut-back, more work is needed on the layered part. First step is a foundation with Initial Lustre Pastes NF, sprinkled with CL-F or shoulder material and fired at 900°C.

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Fig. 2 c: The final bake is Enamel and Enamel Opal Booster from Zr-FS (or LiSi). This is what we can call our basic product.

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Fig. 3c After final dentine bake



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Fig. 3d Try-in



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Fig. 3e: Final result.

All ceramic materials will fail if you don't follow the rules; if you try to cheat the system, it will beat you.

Clinical case reports

Case 1



Fig. 4: Intraoral image of the initial situation



Fig. 5: Digital mock-up

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In most cases we start with clinical picture taking followed by the impression taking (digital or analog). Next step is to decide on the treatment plan.

We always aim to have the final product, form and function finished before we start with the final work.

The digital plan is made with a standard dental CAD program and after liaising with the dentist and patient, a mock-up (Fig. 5) is designed and printed.

After mock-up and a provisional phase, we start up the creation of the final restoration – a zirconia bridge - following our standard protocol: **Zirconia Disk HT, Initial Zr-FS, Initial Lustre Pastes NF, Initial Spectrum Stains**.

First step is to ensure that your framework is close to the desired colour (Figs. 7 and 8). We are currently using Initial Zirconia Disk which we infiltrate with colouring liquids.



Fig. 6: Intraoral mock-up





Fig. 7: Shade selection on the oral scan



Zirconia: Aesthetic, strong and predictable

Shade matching of the framework (Fig. 9) is an optional step and not really required in our case as we apply a foundation layer with Initial Lustre Pastes NF in order to secure the colour.

A layer of Initial Lustre Pastes NF is applied and fired (Fig. 9) after which Dentin, Enamel and Effect colours are added to the framework. At this point we want to reach a slightly darker/ warmer colour than the final level. (Fig. 10).

If required we can apply a second layer or adjust it with Initial Spectrum Stains in a later phase. If the desired result is achieved, we continue with the layering using Initial Zr-FS.

For the first layer we applied INside IN-46 in the approximal areas, Dentin D-A3 and a touch of A3.5 at the cervical area. For the incisal part we applied TM-01, -05 and some CT-22, on top of that some thin areas for discrete mamelons were made with Inside 44 (Fig. 11). We always fire this first, with the normal dentine program. Why we do this is simple: If we are not happy with the outcome we can go for an internal staining with Initial Spectrum Stains to reach the desired result.

When we have obtained the required colour, we cover the first build-up with CL-F and enamel, maybe some CT-22/24 at the cervical area (Fig. 12).

The final steps are managing shape and surface structure, glazing and polishing.



Fig. 8: Initial zirconia framework



Fig. 9: Shade matching



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Fig. 10: After application of Initial Lustre Pastes NF



Fig. 12: Shade check



Fig. 14: End result seated in the mouth of the patient



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Fig.11 First ceramic layer with different powders for cervical and incisal area



Fig. 13 (a and b) After the final colour check and cleaning, the restoration is ready to be sent to the dentist.



Case 2

As always, the case started with clinical picture taking (Fig. 15) followed by the impression taking The treatment plan is always based on the initial assessment.

After preparation of the teeth, the temporary restorations were made using CAD/CAM; (Fig. 16); in this stage, only the upper jaw was done (Figs. 17 and 18).



Fig. 15a Initial oral situation



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Fig. 15b Initial oral situation



Fig. 16: Digital wax-up to create a plan and temporary constructions.

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Fig. 17: Preparations



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Fig. 19: Framework design based upon digital wax-up



Fig. 18: Temporaries – upper jaw only.



Fig. 19: Reduced framework design

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The lab stages:

The first step was designing the framework after the decided plan.

Zirconia: Aesthetic, strong and predictable



Fig. 20: The framework milled from Zr disk, infiltrated with colouring liquids and sintered _____



Fig. 21: Framework with Lustre Pastes and sprinkled with Initial Zr-FS CL-F just before firing _____



Fig. 22: Fired at 900°.



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Fig. 23: INside and Fluo Dentin



Fig. 24: Dentin, Translucent Modifier and CL-F.

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Fig. 25: The internal staining with Initial Spectrum Stains can be clearly seen.



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Figure 26: First layer of enamel and Enamel **Opal Booster**



Fig. 28: Glazed and polished







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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 http://www.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 EUROPE N.V.** • Head Office • Researchpark Haasrode-Leuven 1240 • Interleuvenlaan 33 • B-3001 Leuven Tel. +32.16.74.10.00 • Fax. +32.16.40.48.32 • info.gce@gc.dental • http://www.gceurope.com

GC UNITED KINGDOM Ltd.

Coopers Court Newport Pagnell UK-Bucks. MK16 8JS Tel. +44.1908.218.999 Fax. +44.1908.218.900 info.uk@gc.dental http://uk.gceurope.com

GC NORDIC

Danish Branch Scandinavian Trade Building Gydevang 39-41 DK-3450 Allerød Tel: +45 23 26 03 82 info.denmark@gc.dental http://denmark.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 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 NORDIC AB

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

