GC get connected 13

Your product and innovation update

2019

Cover image: courtesy of CDT Leonardo Cavallo, Italy.

Contents

Dear readers

Welcome to the 13th edition of GC's Get Connected newsletter.

A couple of months ago, during the IDS 2019, GC presented many new and highly innovative products to the dental community. We're happy to report that they were received exceedingly well.

In this edition of GC Get Connected, you will find a selection of clinical case reports with some of the latest additions to our product portfolio.

- *A Simplified System for Adhesive Bonding Procedures with EQUIA Forte HT*
- *An efficient approach to the restoration of worn incisors with EXACLEAR*
- *Considerations for optimal restoration of teeth with perforations using everX Flow*

We hope you find these articles beneficial for your daily work.

Please comment and let us know!

Furthermore, GC is highly committed to nurturing new talents among future generations of dental professionals, as well as to collaborate with numerous universities around the world. In this edition of Get Connected, we present to you the Essentia Academic Contest winner - Ezge Tüter, as well as the results from the Initial LiSi Press Facebook contest.

Enjoy reading this issue of Get Connected!

Josef Richter
COO & President
GC International AG/GC Europe NV

Dr. Ezgi TÜTER *was born in 1991, İstanbul (Turkey). She graduated from Kocaeli University Faculty of Dentistry in 2014 and started her career as a dentist.*
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He defended his doctorate thesis 'The assessment of dimensional alterations of worn incisors in different time periods' and obtained his PhD degree and the title 'Restorative Dentistry Specialist' at the Dentistry Faculty, Restorative Department of Marmara University in 2015. He has been working as an Assistant Professor at the same department since 2009.
He has many national and international studies and publications about direct aesthetic restorations, tooth wear and early diagnosis of caries lesions.
He has been involved in given many national and international lectures and courses about direct anterior and posterior aesthetic restorations, dental photography and tooth bleaching since 2012.
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Direct Veneers with Polychromatic Layering: A Case Report

By **Ezgi Tüter** and **Ass. Prof. Bora Korkut,** Turkey

Discolourations of the anterior dentition are one of the main aesthetic problems for many patients. These problems can be solved with direct and indirect restorations. Minimally invasive direct composite veneer restorations have become very popular with the recent developments in adhesive dentistry (Fig. 1)

Fig. 1: Initial situation (left) and final result (right)

Direct Veneers with Polychromatic Layering: A Case Report

A 21-year-old female patient suffering from the aesthetic appearance of her maxillary anteriors consulted the clinic. She had old and discoloured composite restorations, including secondary caries (Figs. 2-4). First of all, remaining occlusal contacts were checked and direct composite veneers on maxillary incisors and canines were considered as the treatment plan for the patient.

Fig. 2: Initial situation (extraoral view)

Fig. 3: Initial situation (intraoral view)

Fig. 4: Initial situation (contrastor view)

Periodontal treatment, office bleaching and direct composite veneer restorations were planned respectively. Following periodontal treatment, two sessions of 20 minutes in office bleaching (40% hydrogen peroxide gel) were done. A mobile dental photography (MDP) device with cross-polarisation filter was used to obtain the most accurate shade selection[1] (Fig. 5). The shades were selected using the button technique and 'MD' and 'LE' shades were selected (Essentia, GC, Japan).

Fig. 5: Shade selection

Following rubber dam isolation, the old discoloured restorations were removed (Figs. 6 and 7).

Fig. 6: Rubber dam isolation

Fig. 7: Preparation

Former restorations were removed minimally invasively.[2] During preparation, D-Light Pro (GC) was used in detection mode to prepare the cavities conservatively, making sure to remove only infected dentin and old composite restorations.[3] 45° slight bevelings were prepared for aesthetic concerns only. The silicone index was checked in the patient's mouth and modified to be used with the rubber dam isolation (Fig. 8).

Fig. 8: Silicone palatal index

Prepared surfaces were etched with 37.5% orthophosphoric acid gel.[4] A universal adhesive agent (G-Premio BOND, GC) was applied for 10 seconds and was dried for 5 seconds with maximum air pressure and light cured for 10 seconds with D-Light Pro (GC). The palatal wall was formed using the silicone index[5] and the marginal wall was created using a kidney-shaped partial matrix band.[6] Boxes were created for each tooth and a polychromatic, incremental stratification technique was used to restore the teeth (Fig. 9).

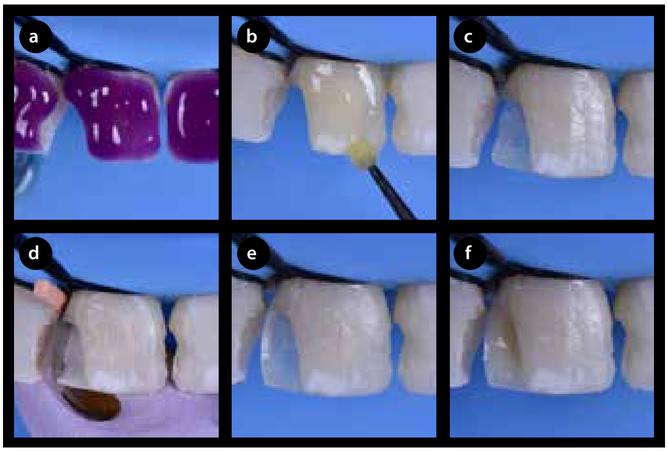


Fig. 9: Restorative protocol: a) Etching; b) Adhesive application; c) Palatal wall; d) Matrix and wedge placement; e) Marginal wall; f) Stratification.

Glycerine gel (Gradia Air Barrier, GC) was applied to avoid formation of the oxygen inhibition layer on all the restoration surfaces (Fig. 10). The gel was used immediately after the layering, prior to polishing. Al_2O_3-embedded polishing discs in different grain sizes were used for marginal roundings. Surface polishing was done using diamond-particles-embedded rubber spiral wheels (Figs. 11 and 12).

Fig. 10: Glycerine gel application

Fig. 11: Surface polishing (pre-polisher)

Fig. 12: Surface polishing (high-shine polisher)

Coarse, medium, fine and extra fine interdental strips (EPITEX, GC) were used, respectively (Figs. 13-16) for polishing (Fig. 17). Rubber dam was removed (Figure 18) and the patient was called for one-week (Fig. 19), one-month (Figure 20, 21), three-month (Fig. 22) and six-month (Fig. 23) follow-up appointments.

At all the presented follow-up appointments, all the restorations were scored according to the modified USPHS (United States Public Health Service) criteria[7], and all the scores were considered as 'successful' in each period. Although it has not yet been a long evaluation time, under the conditions of the case presented, direct composite veneers were considered as a single visit, minimally invasive, functional, aesthetic and stable treatment option for the restoration of anterior teeth.[8]

Fig. 13: Interdental polishing (coarse)

Fig. 14: Interdental polishing (medium)

Fig. 15: Interdental polishing (fine)

Fig. 16: Interdental polishing (extra fine)

Fig. 17: Restorations immediately after treatment

Fig. 18: Restorations immediately after treatment (contrastor view)

Fig. 19: One-week follow-up

Fig. 20: One month follow-up

Fig. 21: One-month follow-up

Fig. 22: Three-month follow-up

Fig. 23: Six-month follow-up

References

1. Sascha H, Tapia J and Bazos P. eLABor_aid: a new approach to digital shade management. Int J Esthet Dent, 2017; 12(2):186-202.
2. Aida A, Nakajima M, Seki N, Kano Y, Foxton RM and Tagami J. Effect of enamel margin configuration on color change of resin composite restoration. Dent Mater J, 2016; 35(4):675-683.
3. Schott T C and Meller C. A new Fluorescence-aided Identification Technique (FIT) for optimal removal of resin-based bracket bonding remnants after orthodontic debracketing. Quintessence Int. 2018;49(10):809-813.
4. Peumans M. Clinical performance of direct and ındirect adhesive restorations. jCD, 2015; 31(1):110-127.
5. Ammannato R, Ferraris F and Marchesi G. The index technique in worn dentition: a new and conservative approach. Int J Esthet Dent, 2015; 10:68-99.
6. Goyal A, Vineeta N and Ritu S. Diastema closure in anterior teeth using a posterior matrix. Case Rep Dent, 2016; 2016:2538526. 1-6.
7. Lempel E, Lovász BV, Meszarics R, Jeges S, Tóth Á and Szalma J. Direct resin composite restorations for fractured maxillary teeth and diastema closure: A 7 years retrospective evaluation of survival and influencing factors. Dent Mater, 2017; 33(4): 467-476.
8. Korkut B. Smile make-over with direct composite veneers: two years follow-up report. J Dent Res Dent Clin Dent Prospects, 2018; 12(2):146-151.

An aesthetic and biomimetic approach with a glass hybrid for direct restorations

by Ass. Prof. **Zeynep Bilge Kütük,** Turkey

Assistant Prof. Zeynep Bilge Kütük *graduated from Hacettepe University School of Dentistry in 2007 and started her doctoral studies at the Department of Restorative Dentistry from the same university in 2009. She went to the research laboratories of the Restorative Dentistry Department of Ludwig Maximillians University in Munich, Germany, with a scholarship of the Continental European Division (CED/IADR) of the International Association for Dental Research (IADR). She obtained her PhD in 2015. She received the title of Assistant Professor in 2017. She has been a member of the IADR since 2009. She has published several articles in international and national journals. She participated in several international trainings on minimally invasive aesthetic applications and is a trainer in hands-on courses on aesthetic restorations with current approaches.*

Glass ionomer (GI) was first introduced in the 1970s[1]. Currently, it is extensively being used for cores, bases/liners, and the cementation of posts, crowns, and fixed bridges. Although, they have numerous advantages, the first GIs were thought to be too rough or unaesthetic due to their opacity for anterior restorations and not durable enough for posterior restorations. However, GIs have been greatly improved since they were first introduced. Many of those earlier concerns have now been fully addressed by manufacturers.

In 2007, EQUIA was launched, a restorative system comprising a GI and a synergistic light-cured nano-filled coating agent. It became the first GI-based system that was indicated for permanent Class II restorations, albeit with cavity size restrictions. Eight years later, the first glass hybrid system, EQUIA Forte, was launched, based on the success of EQUIA.

Owing to the new glass hybrid filler technology, the indications for EQUIA Forte could be extended to load-bearing Class II restorations (without cusp involvement). While composite resins are often the first choice for direct aesthetic restorations, specific features of GIs may make them a better choice in certain indications.

The overall goal of this article is to provide the clinician with an overview of the information on a newly developed glass hybrid system (EQUIA Forte HT) and as well as to give useful application tips based on results from clinical cases.

Bulk-fill properties

EQUIA and EQUIA Forte restorative systems are both placed easily in 'bulk' directly in a cavity, very similar to amalgam, without limitations in depth of cure. Moreover, they can be placed in a short time (around 3 min) and without any adhesive procedure. For this reason, they are truly one of the best choices for bulk fill application method. They do not generate the shrinkage stresses that occur in composite restorations and their elastic modulus is very closed to dentine, which makes them a unique biomimetic dentine replacement material.

GIs and glass hybrids form an ionic chemical bond to the calcium found in the hydroxyapatite of both enamel and dentine. Though cleaning the cavity with a mild cavity conditioner (10 or 20% polyacrylic acid) is beneficial, no surface pretreatment is required. The adhesion of GI to tooth structure is less technique sensitive than composite resins and its quality increases with time[2]. In 2005, Peumans *et al.*[3] reported that GI restoratives exhibited superior retention and clinical performance than adhesive resin systems.

On the other hand, composite resins always require a clean field and should ideally be placed under a rubber dam to prevent contamination during placement.

Favourable physical and biological properties

Reconstructions of posterior teeth with deep caries lesions are still a challenge for restorative dentistry because of the absence of sufficiently resistant restorative materials with favourable biological properties. Previously, GIs had their limitations in load-bearing areas due to their lower physical properties, and necessitated regular monitoring if placed as a permanent restoration[4].

The light-cure resin coating application (EQUIA Coat and EQUIA Forte Coat) of the EQUIA and EQUIA Forte restorative systems makes them more aesthetic and gives a shiny appearance to the restorations, seals the margins, provides wear resistance and protects from early moisture sensitivity until maturation is completed, resulting in a high compressive strength.

Based on my clinical experiences I could express that the use of encapsulated forms GI and glass hybrid restorative systems minimises variations in handling and give satisfying outcomes in teeth with deep carious lesions, especially in young patients.

The best-known property of GIs is constant release of fluoride. Immediately after the contact of the acids to the surface of GI restoration, fluoride ions are release from the surface and neutralise them. The fluoride ions can be resorbed by the GI restoration and recharge it for the next acid challenge when teeth are brushed with a fluoride toothpaste, or a fluoride oral rinse is used. The polymer matrix of composite resins, on the contrary , does not allow ion exchange with the oral environment. When some soft infected dentine was left over the pulp wall by sealing the cavity with a bioactive material like GI, the caries progression arrested and sometimes even regressed. Besides their role in remineralisation, fluorides, calcium, phosphate and strontium ions transfer from GI into the deep demineralised dentine. So, the pulp can remain vital without any pulp capping agents and postoperative sensitivity[5].

The benefits of glass hybrid technology

What differentiates glass hybrid from other conventional GI restoratives is its chemistry. The highly reactive fluoro-alumino-silicate (FAS) micron-sized fillers (<4 µm) were added to the standard FAS glass filler particles of EQUIA Fil. The micron-sized filler particles release more metal ions, which improve the cross-linking of the polyacrylic acid matrix and the overall physical properties. Additionally, EQUIA Forte Fil liquid comprises a high-molecular-weight polyacrylic acid, which helps to improve the chemical stability, acid resistance, and physical properties of the set cement. The light-cured, nano-filled resin coating (EQUIA Forte Coat) was improved by incorporating a reactive multifunctional monomer that increases resistance to wear, has a higher polymerisation conversion and thinner film layer, and also provides a smoother surface to the final restoration.

Long-term clinical trials

Long-term clinical studies of the EQUIA restorative system were reported, exhibiting clinically successful outcomes in Class I and Class II lesions[6-10]. Under the guidance of Professor Gurgan, we evaluated the clinical performance of EQUIA restorative system in conservative Class I and II cavities and compared it with a micro-hybrid composite (Gradia Direct Posterior/GC). Nowadays, this 8-year evaluation of this clinical trial has been completed. According to results of this trial, both tested restorative materials showed an acceptable success rate after 8 years. EQUIA restorative system has been used as a routine restorative in the treatment of permanent teeth in Hacettepe University School of Dentistry Restorative Dentistry Clinics, where I performed my clinical studies since 200911.

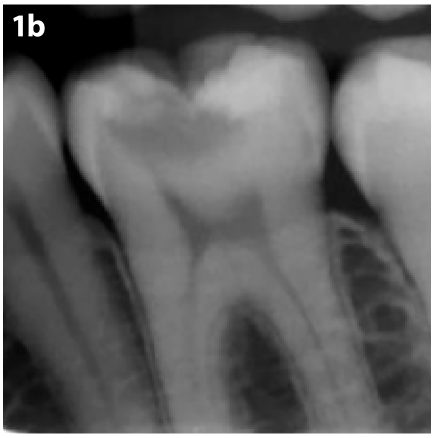
In 2015, we started another clinical trial again under the guidance of Professor Gurgan and evaluated the clinical performance of EQUIA Forte restorative system in large Class-II cavities and compared with a micro-hybrid composite (G-ænial Posterior, GC). According to results of our clinical trial, EQUIA Forte restorations showed negligible retention failure and mismatch in colour, both restorative materials exhibited successful performances for the restoration of large Class II cavities after 24 months[12].

To improve the clinical success of these restorations, following elements are important:

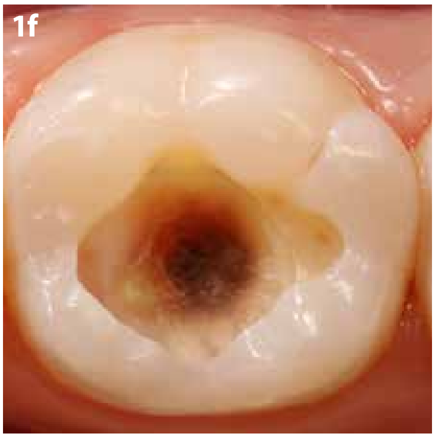
1. To respect the cavity size indications
2. The use of preformed metal sectional matrix systems to restore multi-surface cavity preparations
3. To keep prepared surfaces moist (glistening). Do not dissicate!
4. Not to remove the matrix before setting of the restoration and be careful while removing it
5. To await disappearance of the lustre of the restoration before contouring
6. To round the edge of the proximal margin of the restoration and to check the occlusion after making sure that the restoration border is positioned correctly
7. To use hand instruments that are not sticking to the unmatured restorative for the adaptation to the cavity walls
8. To thermo-cure the restoratives with LED light curing units before polishing
9. To use the coating

Case 1

EQUIA Forte HT was used in a 34-year-old female patient for the emergency treatment of a vital lower first molar (tooth 36) with a deep, large carious lesion (Fig 1a). The vitality of the tooth was first determined by pulp testing and a radiograph was taken to check the depth of the lesion (Fig 1b). Local anaesthesia was applied and caries was removed using tungsten carbide burs (Busch "AU" Carbide Burr - TF1AU). Infected dentine was removed with an excavator (Fig 1c). The cavity walls were cleaned with 20% polyacrylic acid (Cavity conditioner, GC) during 10 s (Fig 1d), rinsed thoroughly with water (Fig 1e) and dried gently (Fig 1f). EQUIA Forte HT capsules were prepared and mixed for 10 s, then restorative was directly applied into the cavity in a sufficient quantity using a bulk-fill technique with a special applicator (Fig 1g). EQUIA Forte HT was condensed against the cavity with a plastic hand instrument and was allowed to set undisturbed for approx. 2.5 min (Fig 1h). This restorative does not require a special surface coating during the setting reaction. The finishing process was performed with the use of rotary instruments in 2 steps: a) tapered trimming & finishing tungsten carbide burs were used for forming the fissures and occlusal anatomy of the restoration; b) flame-shaped rubber points (blue and gray) were used for polishing (Fig 1i). All burs and polishers were used under water irrigation to avoid over-drying the restorative. The occlusal contact points were checked (Fig 1j). A final layer of the coating agent (EQUIA Forte HT Coat) was applied on the surface of the restoration without air-blowing (Fig 1k), then it was light-cured for 20 s with a D-Light DUO LED curing device at 1400 mW/cm^2 (Fig 1l). The final clinical and radiographic views of the restoration are shown in Figures 1m-o, demonstrating excellent contour and aesthetics.





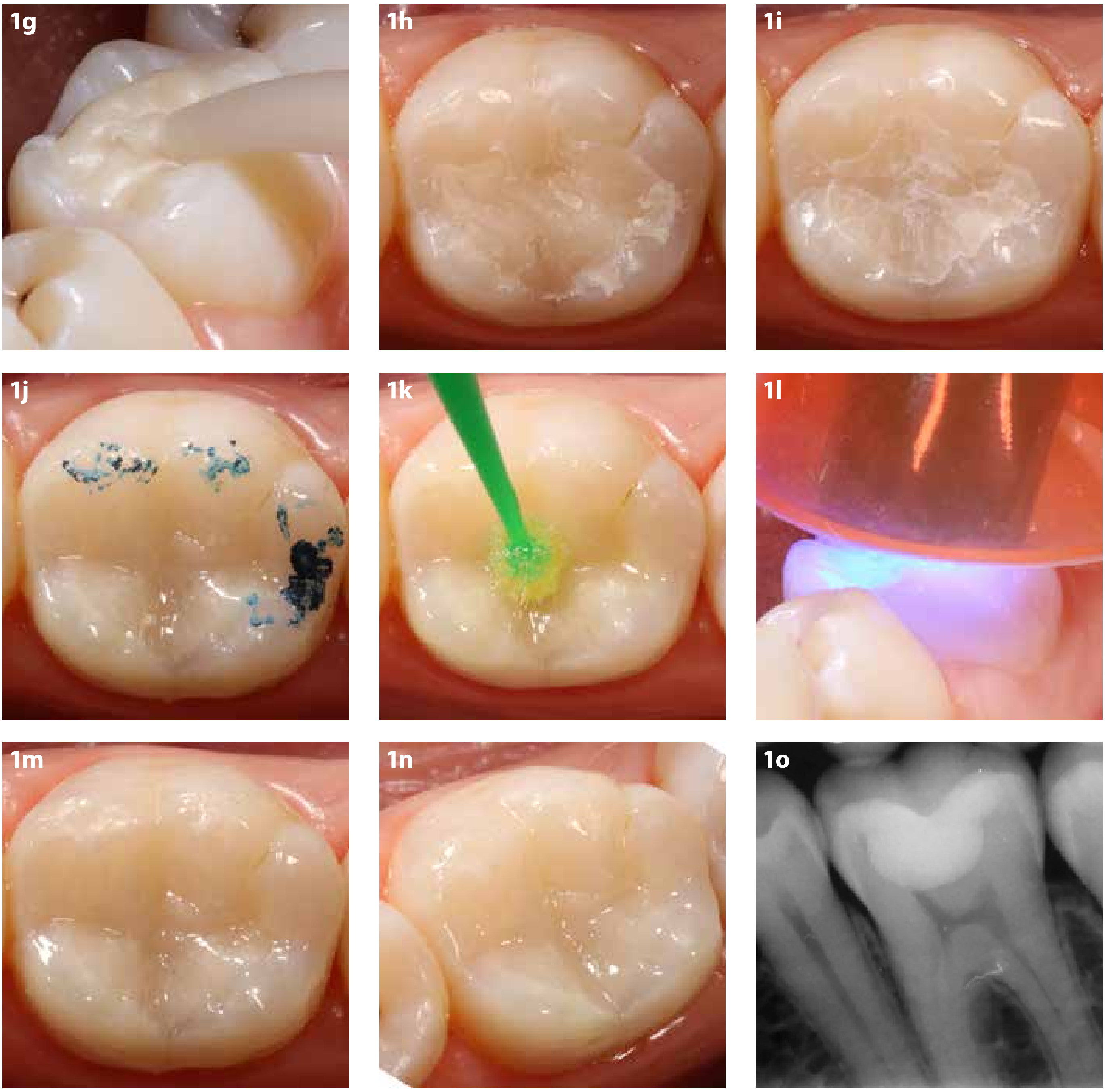
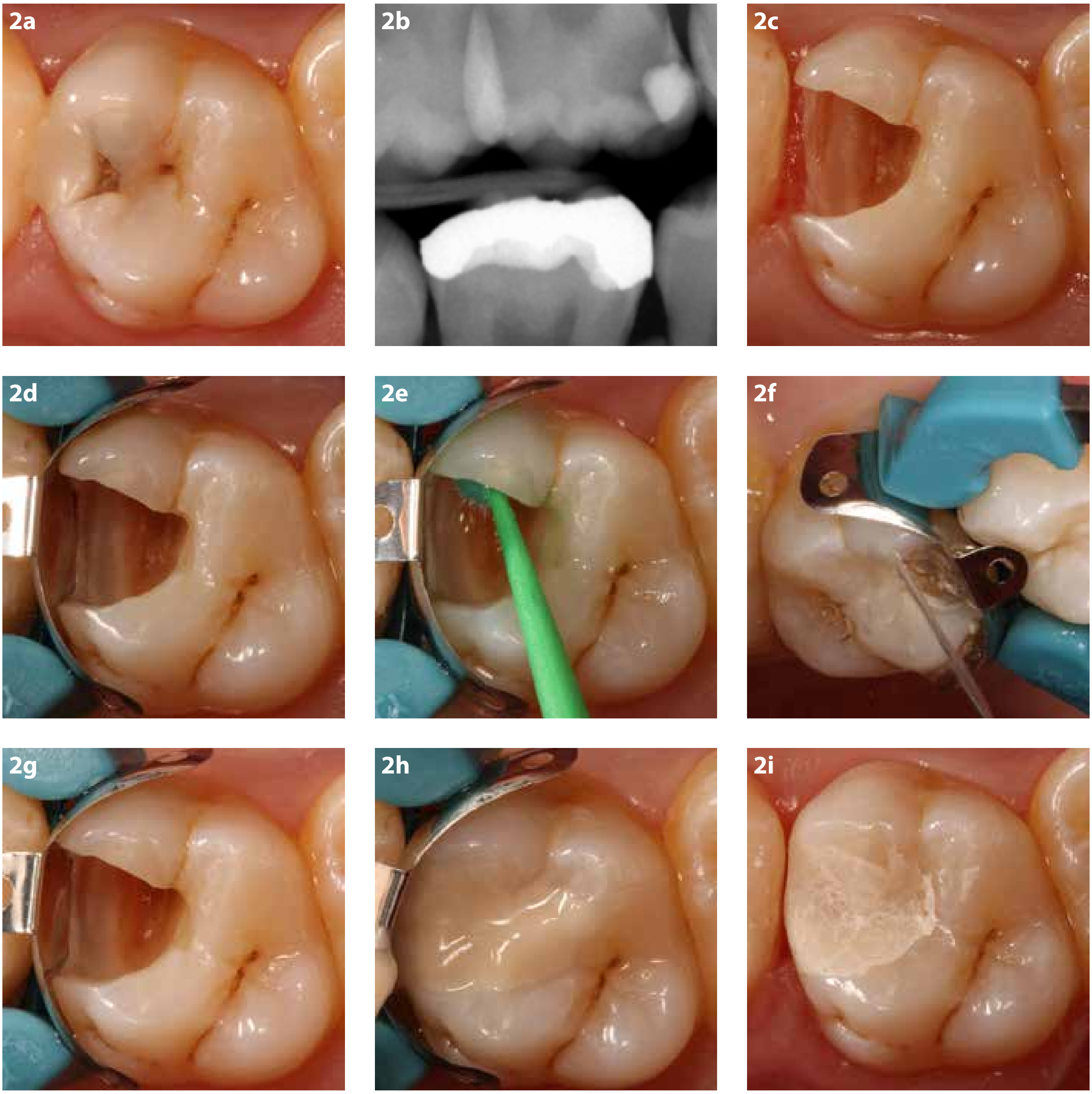


Figure 1. Treatment of a deep occlusal carious lesion with EQUIA Forte HT. **a.** Clinical view of a deep occlusal carious lesion with cavitation in a mandibulary left first molar is shown. **b.** Bite-wing radiograph of deep occlusal carious lesion in a mandatory left first molar. **c.** Clinical view of the cavity after removing the caries lesion. **d-f.** Application of cavity conditioner. **g.** Application of the EQUIA Forte HT to the cavity. **h.** Clinical view of the restoration before polishing. **i.** Clinical view of the restoration after polishing. **j.** Occlusion check with articulation paper. **k.** Application of EQUIA Forte HT Coat onto the restoration surface. **l.** Light-curing of EQUIA Forte HT Coat. **m-n.** Clinical view of the restoration. **o.** Radiograph of the restoration.

Case 2

Case 2 is shown in Figure 2 and 3. In addition to the procedures performed in the first case, a sectional matrix system was used for the restoration of the Class II cavities in this case and for contouring the marginal ridges of the restorations, coarse/medium (40 µm) polishing discs were used. A 19-year-old male patient presented with a history of a high caries rate and a high incidence of recurrent caries. In Figure 2, a failing composite restoration in a maxillary right first molar in need of replacement is shown. The old MO composite restoration was removed and secondary caries was excavated. To decrease the likelihood of further recurrent caries, EQUIA Forte HT was preferred instead of composite for the restoration replacement. In Figure 3, the treatment steps of primary proximal carious lesions in the maxillary left second premolar and first molar are shown.



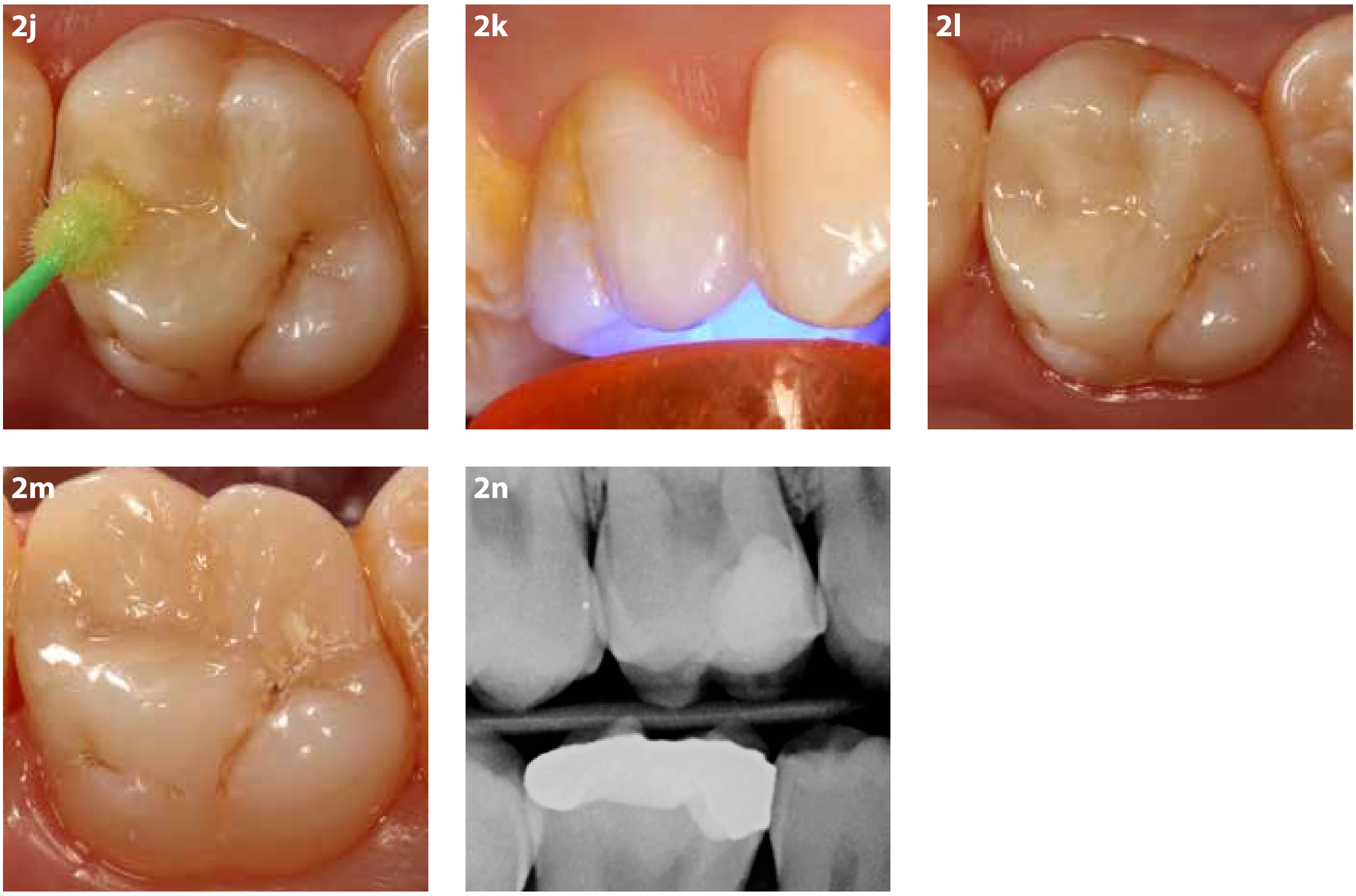


Figure 2. Treatment of a deep proximal secondary carious lesion with EQUIA Forte HT. **a.** Clinical view of a deep proximal secondary carious lesion with cavitation in an upper right first molar is shown. **b.** Bitewing radiographic view of deep occlusal carious lesion in an upper right first molar. **c.** Clinical view of the cavity after removing the old composite restoration and caries lesion. **d.** Placement of sectional matrix to perform proximal contact. **e-g.** Application of cavity conditioner. **h.** Application of the EQUIA Forte HT to the cavity. **i.** Clinical view of the restoration after removing the sectional matrix metal band and polishing. **j.** Application of EQUIA Forte HT Coat to the restoration surface. **k.** Light curing of EQUIA Forte HT Coat. **l-m.** Clinical views of the restoration. **n.** Radiograph of the restoration.

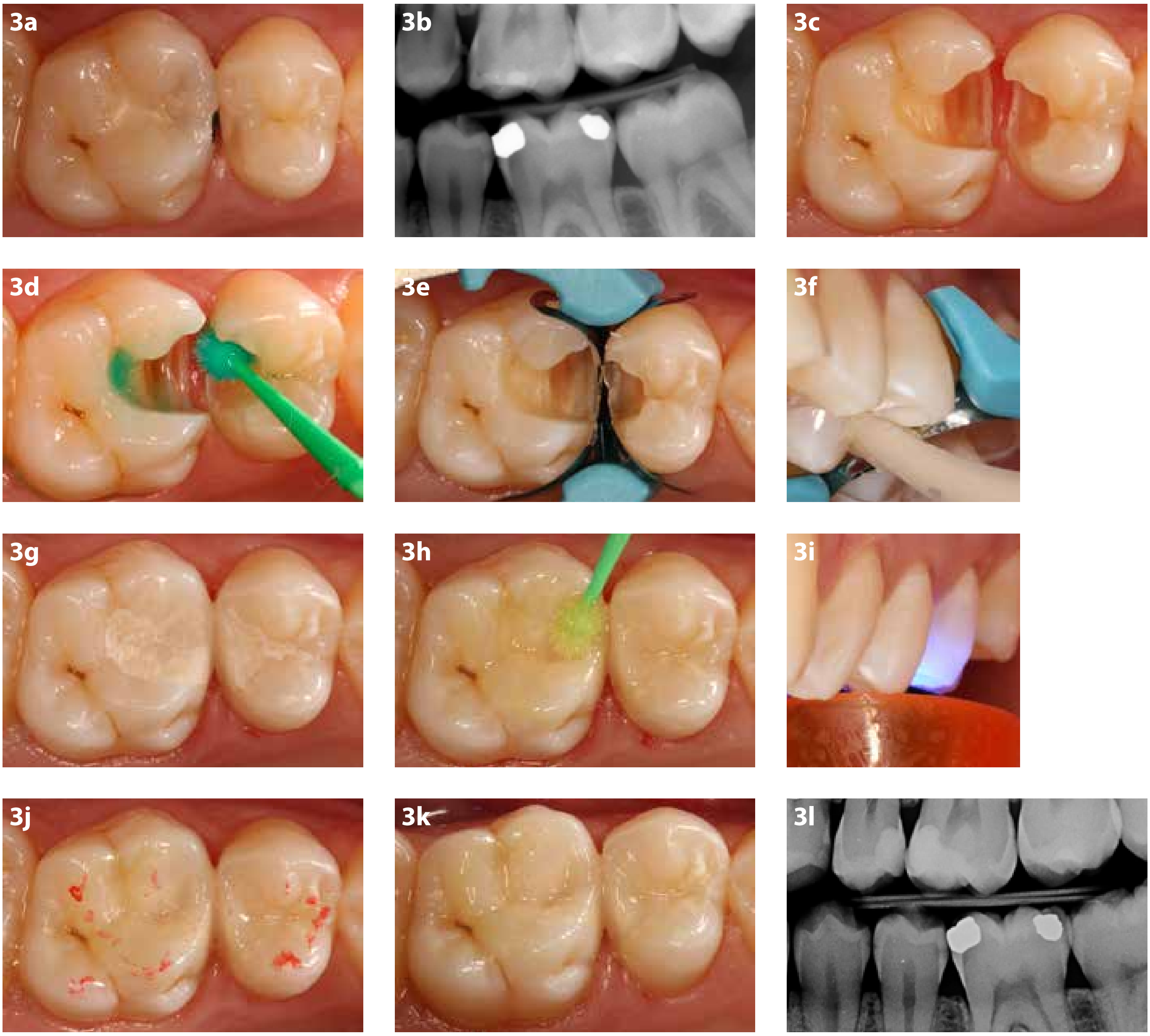
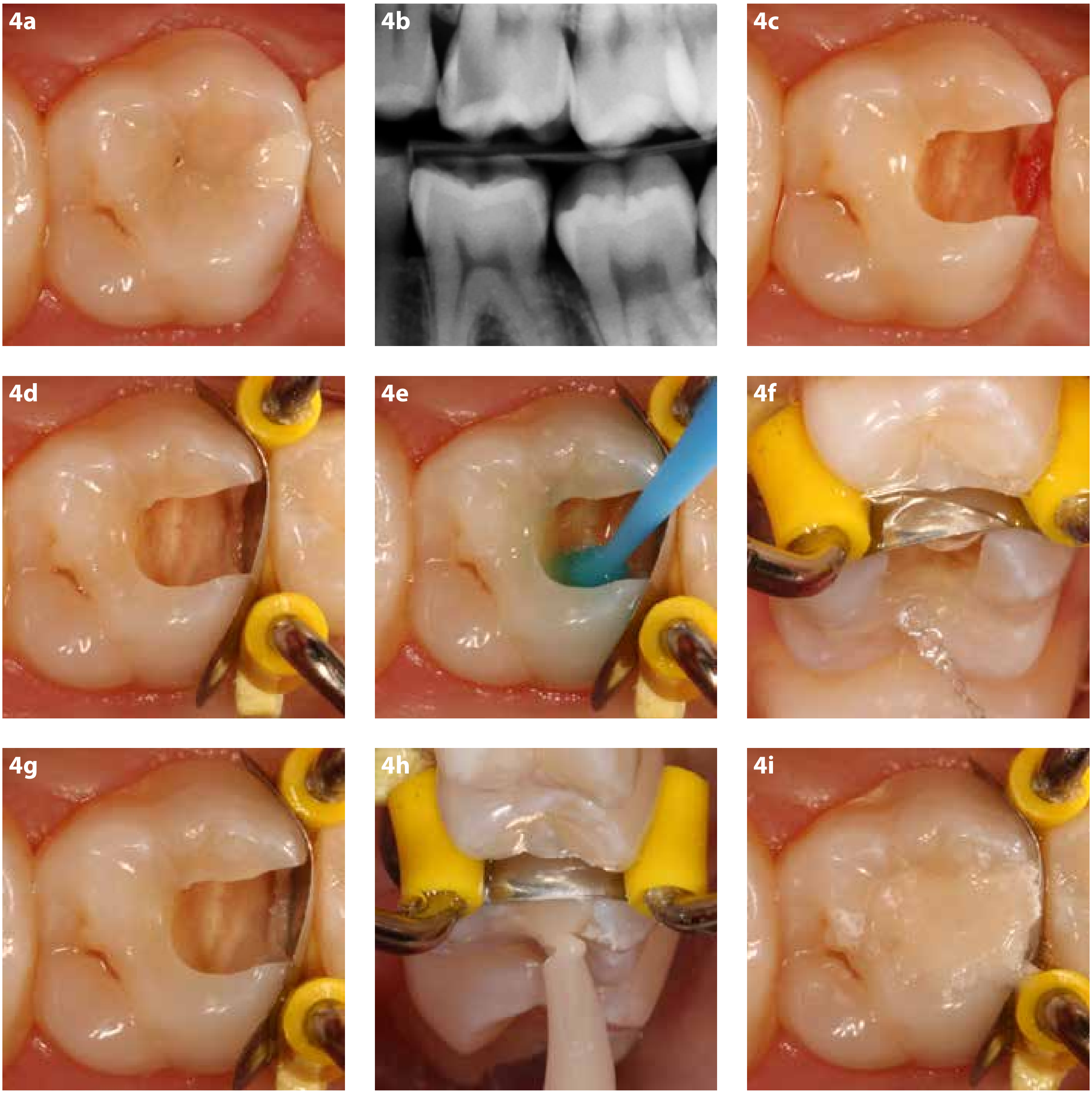


Figure 3. Treatment of contacted proximal carious lesions with EQUIA Forte HT. **a.** Clinical view of two adjacent proximal carious lesions with cavitation in an upper left first molar and second premolar is shown. **b.** Bite-wing radiographic view of proximal carious lesions in an upper left first molar and second premolar. **c.** Clinical view of the cavities after removing caries lesions. **d.** Application of Cavity Conditioner. **e.** Placement of sectional matrix system to create the proximal contacts. **f.** Application of the EQUIA Forte HT to the cavities. **g.** Clinical view of the restoration after removing the sectional matrix metal band and polishing. **h.** Application of EQUIA Forte HT Coat on the restoration surfaces. **i.** Light-curing of EQUIA Forte HT Coat. **j.** Occlusion check with articulation paper. **k.** Clinical views of the restorations. **l.** Radiographic views of the restorations.

Case 3

Case 3 is shown in Figure 4. A 22-year-old female patient with a deep proximal caries lesion in the left maxillary first molar was presented. To eliminate the post-operative sensitivity and aesthetic disquiet it was preferred to restore the cavity with EQUIA Forte HT instead of composite. In Figure 4, the treatment steps of a deep proximal caries lesion in left maxillary first molar is demonstrated.



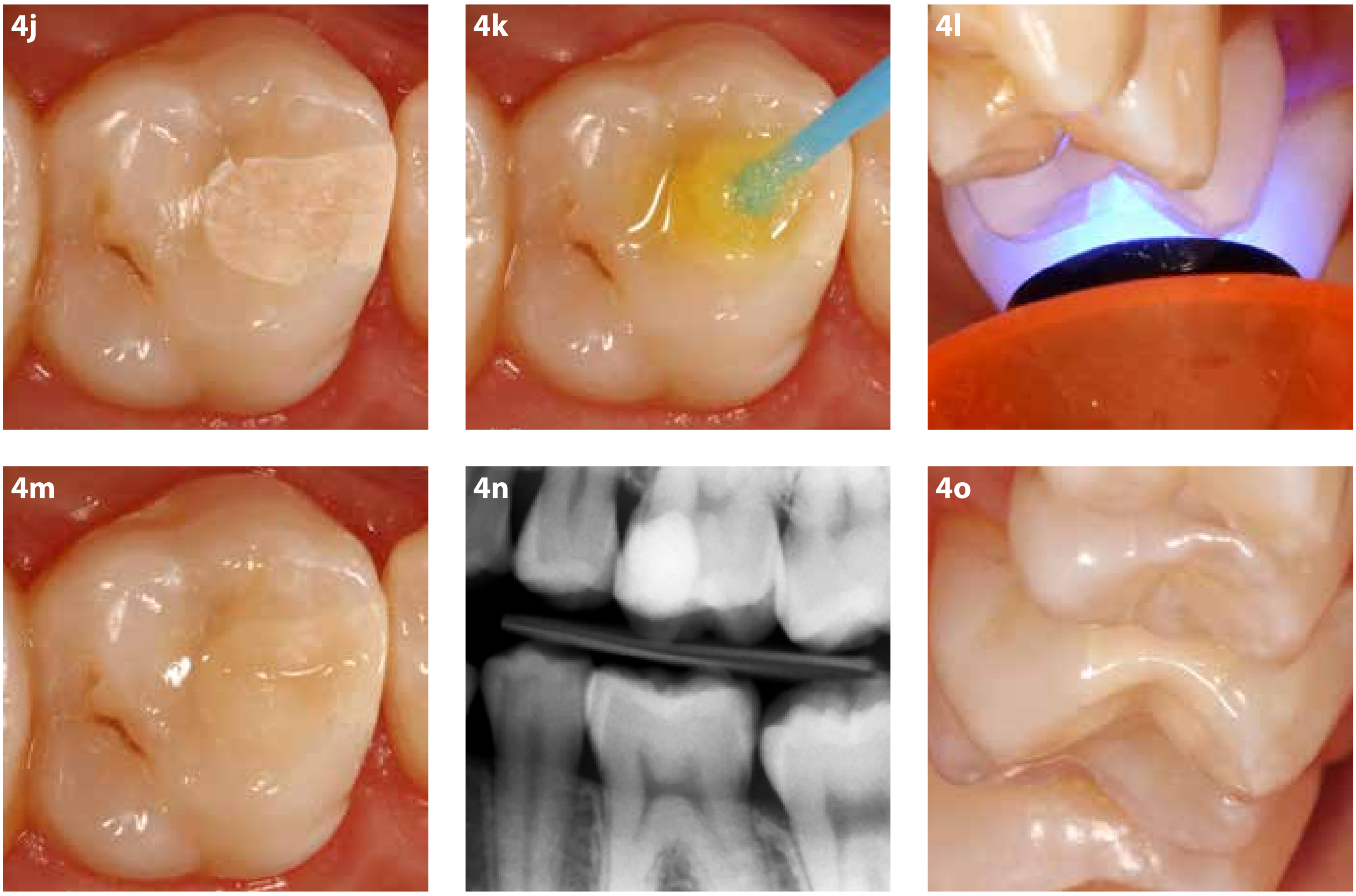


Figure 4. Treatment of a deep proximal carious lesion with EQUIA Forte HT. **a.** Clinical view of a deep proximal carious lesion in an upper left first molar is shown. **b.** Bitewing radiograph of deep proximal carious lesion in an upper left first molar. **c.** Clinical view of the cavity after removing caries lesion. **d.** Placement of sectional matrix to create the proximal contact. **e-g.** Application of cavity conditioner. **h-i.** Application of the EQUIA Forte HT to the cavity. **j.** Clinical view of the restoration after polishing. **k.** Application of EQUIA Forte HT Coat to the restoration surface. **l.** Light-curing of EQUIA Forte. **m.** Clinical view of the restoration. **n.** Radiograph of the restoration. **o.** Clinical view of the margin of the restoration from different side.

References

1. Wilson AD, Kent BE. A new translucent cement for dentistry. The glass ionomer cement. Br Dent J. 1972;132:133-135.
2. Davidson CL. Advances in glass-ionomer cements. J Appl Oral Sci. 2006;14 Suppl:3-9.
3. Peumans M, Kanumilli P, De Munck J, Van Landuyt K, Lambrechts P, Van Meerbeek B. Clinical effectiveness of contemporary adhesives: a systematic review of current clinical trials. Dent Mater. 2005;21:864-881.
4. Combe EC, Burke FTJ, Douglas WH. Clinical Dental Materials. Kluwer Academic Publishers; 1999.
5. Frankenberger R, Garcia-Godoy F, Kramer N. Clinical Performance of Viscous Glass Ionomer Cement in Posterior Cavities over Two Years. Int J Dent. 2009:781462. doi: 10.1155/2009/781462.
6. Gurgan S, Kütük ZB, Ergin E, Oztas SS, Cakir FY. Clinical performance of a glass ionomer restorative system: a 6-year evaluation. Clin Oral Investig. 2017;21:2335-2343.
7. Gurgan S, Kütük ZB, Ergin E, Oztas SS, Cakir FY. Four-year randomized clinical trial to evaluate the clinical performance of a glass ionomer restorative system. Oper Dent. 2015;40:134-143.
8. Diem VT, Tyas MJ, Ngo HC, Phuong LH, Khanh ND. The effect of a nano-filled resin coating on the 3-year clinical performance of a conventional high-viscosity glass-ionomer cement. Clin Oral Investig. 2014;18:753-759.
9. Basso M, Brambilla E, Benites MG, Giovannardi M, Ionescu AC. Glassionomer cement for permanent dental restorations: a 48-months, multi-centre, prospective clinical trial. Stoma Edu J. 2015;2:25-35.
10. Turkun LS, Kanik O. A Prospective Six-Year Clinical Study Evaluating Reinforced Glass Ionomer Cements with Resin Coating on Posterior Teeth: Quo Vadis? Oper Dent. 2016;41:587-598.
11. Kütük ZB, Ergin E, Yalcin FY, Gurgan S. 8-Year Clinical Evaluation of a Glass Ionomer Restorative System. J Dent Res. 2017;96B(0287).
12. Kütük ZB, Ozturk C, Soleimani R, Yalcin FY, Gurgan S. Clinical Performance of a Glass-Hybrid Restorative in Extended-Size Class-II Cavities. Int

FujiCEM Evolve as innovative resin-modified glass-ionomer cement for zirconia restorations: a case report

by **Prof. Roberto Sorrentino**, Italy

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Due to the increasing patients' demand for aesthetics and its optimal biomechanical and optical properties, zirconia is widely used in prosthodontics as a material of choice for indirect ceramic restorations [1-4]. Recently, cubic translucent zirconia has been introduced in the market to improve the optical characteristics and reduce material ageing [3,5,6].

Due to the absence of any glassy matrix, zirconia is free from silica and, consequently, cannot be conditioned with conventional acid etching techniques [1,7,8]. Several surface treatments were suggested in the literature but to date data are still controversial [9,10]. On the basis of the physical-chemical properties of zirconia, in the presence of retentive preparation geometries and full coverage prostheses, conventional water-based luting agents (i.e. glass ionomer and zinc phosphate cements) and hybrid cements (i.e. resin-modified glass ionomer cements) should be considered the first choice materials for cementation [9,11,12].

Case history

A 43-year old male patient treated and stabilised for a previous severe chronic periodontitis asked for the aesthetic rehabilitation of both dental arches, complaining about aesthetic as well as functional problems (Figs. 1-2). After achieving good occlusal stability and proper vertical dimension of occlusion by means of implant-supported metal-ceramics single crowns in the posterior regions, a careful evaluation of the maxillary front teeth was performed, in order to formulate a proper biomechanical and aesthetic treatment plan. Particularly, the patient presented with the following problem list: diastema, tooth wear, high caries activity, moderate staining, unsatisfactory composite restorations, altered interdental proportions, gingival recessions and moderate bone resorption (Fig. 3).

Fig. 1: Extraoral pre-operative view.

Fig. 2: Intraoral pre-operative view.

Fig. 3: Pre-operative detail of the maxillary front teeth.

Treatment

According to the patient's requests and taking the aesthetic needs and biomechanical drawbacks of the case (i.e. deep bite, long lever arms) into consideration, 6 cubic translucent zirconia single crowns were planned, in order to achieve a natural tooth-like appearance of the restorations and optimal mechanical resistance during function.

Minimally invasive vertical tooth preparations were performed on the maxillary front teeth, removing the previous composite restorations and secondary decays and keeping satisfactory total occlusal convergence. The prosthetic margins were iuxtagingivally placed and all the teeth were kept vital (Figs. 4-6). Temporary acrylic resin restorations were used for 3 weeks to allow the soft tissues to recover from preparation and impression procedures.

Fig. 4: Maxillary front teeth preparations for single crowns.

Fig. 5: Detail of the right side tooth preparations.

Fig. 6: Detail of the left side tooth preparations.

FujiCEM Evolve as innovative resin-modified glass-ionomer cement for zirconia restorations: a case report

Subsequently, 6 cubic translucent zirconia single crowns were fabricated (Fig. 7). The buccal surfaces were layered with a dedicated veneering ceramics, so as to extol the aesthetic appearance, whereas the palatal functional aspects were left in the monolithic configuration and glazed, in order to avoid any risk of chipping. Because of the excellent biocompatibility of zirconia, the prosthetic iuxtagingival margins were manually polished and left unglazed to promote the formation of an epithelial attachment and optimise the biological integration of the restorations.

The inner zirconia surface of each crown was conditioned with mild sandblasting using 110 µm alumina particles at 0.2 MPa. An innovative paste-paste resin-modified glass ionomer luting agent (FujiCEM Evolve) was used to cement the restorations (Fig. 8). As this type of luting agent does not require complete field isolation and allows to perform a conventional cementation procedure, PTFE tapes were used to protect the adjacent teeth (Fig. 9). After seating the restorations, cement gelification was achieved by means of light-curing; this passage is not mandatory but allows for a faster setting of the luting agent. Then, cement excess was removed with a urethane dimethacrylate curette, in order not to damage the glazed surface of the ceramic crowns (Fig. 10), and dental floss was used to clean the interproximal spaces (Fig. 11). The same approach was used to cement the zirconia crowns onto lateral incisors (Fig. 12) and canines (Fig. 13). Finally, post-curing was performed after applying an oxygen barrier so as to achieve complete setting of the cement at marginal level (Fig. 14).

Fig. 7: Layered cubic zirconia anterior single crowns. A: internal view; B: buccal view.

Fig. 8: Maxillary central incisor zirconia crowns filled with resin-modified glass-ionomer cement.

Fig. 9: PTFE- assisted cementation of the maxillary central incisors.

Fig. 10: Cervical cement excess removal from central incisors.

Fig. 11: Interproximal cement excess removal from central incisors.

Fig. 12: PTFE- assisted cementation of the maxillary lateral incisors.

Fig. 13: PTFE- assisted cementation of the maxillary canines.

Fig. 14: Light-curing of the prosthetic margins of the zirconia crowns through the oxygen barrier.

Thanks to the excellent biocompatibility of zirconia, to the precision of the prosthetic margins and to the optimal performance of FujiCEM Evolve, 2 weeks after cementation the aesthetic and biological integration of the zirconia crowns was ideal, with good recovery of the gingival health and proper periodontal maturation (Figs. 15-17).
Due to economic reasons, the patient decided to have the severely worn and malpositioned mandibular front teeth (Fig. 18) restored with composite restorations. Consequently, the area was restored by means of direct restorations applied using the flowable composite (G-ænial Universal Flo) injection technique (Figs. 19-20).

Proper dynamic and occlusal functions were restored and carefully checked (Figs. 21-23). Moreover, the final outcome showed a good aesthetic

Fig. 15: 2-week soft tissues healing after cementation: front view of the cubic zirconia single crowns.

Fig. 16: Post-operative right side detail of the cubic zirconia single crowns.

Fig. 17: Post-operative left side detail of the cubic zirconia single crowns.

Fig. 18: Pre-operative view of the mandibular front teeth.

Fig. 19: Restoration of the mandibular front teeth by means of the composite injection technique with G-ænial Universal Flo.

Fig. 20: Post-operative view of the mandibular from teeth restored with injected direct composites.

Fig. 21: Post-operative view: layered cubic zirconia single crowns at the maxillary arch and injected direct composite restorations at the mandibular arch.

Fig. 22: Functional occlusal check at the maxillary arch.

Fig. 23: Functional occlusal check at the mandibular arch.

Fig. 24: Extraoral post-operative view.

restoration of the patient's smile line (Fig. 24).

Outcome

Different advantages were noticed using FujiCEM Evolve, like ease of use (the possibility to use the automixing dispenser makes cement application very slightly dependent on the operator's skill), moisture tolerance (ideal in the presence of iuxta- or sub-gingival margins and requiring no isolation) and versatility (suitable for different restorative materials). Particularly, in the present case this luting agent was used to cement both zirconia crowns in anterior areas and metal-ceramics crowns onto posterior implants, showing the same flowability and easiness in cement excess removal, due to its user-friendly rubbery consistency, very useful to avoid the entanglement of any particle within the soft tissues.

Furthermore, no ceramic pre-treatment is mandatory before the application of the cement and the dual-curing technology allows for a faster setting using light-polymerisation.

Thanks to its innovative features, FujiCEM Evolve allowed to avoid any post-operative sensitivity and its radiopacity makes the identification of possible sub-gingival excess very easy.

Acknowledgements

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REFERENCES

1. Zarone F, Russo S, Sorrentino R. From porcelain- fused-to-metal to zirconia: clinical and experimental considerations. Dent Mater 2011;27:83-96.
2. Fabbri G, Fradeani M, Dellificorelli G, et al. Clinical evaluation of the influence of connection type and restoration height on the reliability of zirconia abutments: A retrospective study on 965 abutments with a mean 6-year follow-up. Int J Periodontics Restorative Dent 2017;37:19-31.
3. Shahmiri R, Standard OC, Hart JN, Sorrell CC. Optical properties of zirconia ceramics for esthetic dental restorations: A systematic review. J Prosthet Dent 2018;119:36-46.
4. Zhang Y, Lawn BR. Evaluating dental zirconia. Dent Mater. 2019 Jan;35(1):15-23.
5. Camposilvan E., Leone R, Gremillard L, et al. Aging resistance, mechanical properties and translucency of different yttria-stabilized zirconia ceramics for monolithic dental crown applications. Dent Mater 2018;34:879-890.
6. Rodrigues CDS, Aurélio IL, Kaizer MDR, Zhang Y, May LG. Do thermal treatments affect the mechanical behavior of porcelain-veneered zirconia? A systematic review and meta-analysis. Dent Mater. 2019 Mar 4. pii: S0109-5641(18)31467-2.xs.
7. Zarone F, Sorrentino R, Vaccaro F, et al. Acid etching surface treatment of feldspathic, alumina and zirconia ceramics: a micromorphological SEM analysis. Int Dent South Afr 2006;8:50-56. 274.
8. Maroulakos G, Thompson GA, Kontogiorgos ED. Effect of cement type on the clinical performance and complications of zirconia and lithium disilicate tooth-supported crowns: A systematic review. Report of the Committee on Research in Fixed Prosthodontics of the American Academy of Fixed Prosthodontics. J Prosthet Dent. 2019 Mar 15. pii: S0022-3913(18)30712-1. doi: 10.1016/j.prosdent.2018.10.011. [Epub ahead of print].
9. Pilo R, Dimitriadi M, Palaghia A, Eliades G. Effect of tribochemical treatments and silane reactivity on resin bonding to zirconia. Dent Mater 2018;34:306- 316.
10. Schünemann FH, Galárraga-Vinueza ME, Magini R, Fredel M, Silva F, Souza JCM, Zhang Y, Henriques B. Zirconia surface modifications for implant dentistry. Mater Sci Eng C Mater Biol Appl. 2019;98:1294-1305.

Bonding of ceramic veneers

By **Prof. O. Etienne and Dr. B. Cournault,** France

__Prof. Olivier Étienne__ is Assistant Professor and Head of the Prosthetics Unit of the Faculty of Dental Medicine in Strasbourg (France). He is Doctor of Odontological Sciences (PhD) and devotes his research to surface characteristics and their interaction with biological tissues. His clinical practice focuses on complex prosthetic rehabilitation and aesthetics, on natural teeth and on implants. Alongside his academic activity, he has been working in a private practice for 20 years. Author and co-author of several publications and books (including "Aesthetic Ceramic Bonded Restorations" (in French), Ed. CdP, 2016) as well as of numerous articles and briefings on the topics of cosmetic and implant dentistry, he actively participates in various continuing education societies and is involved in Post-University Degrees in implantology and smile design.

__Dr. Bérangère Cournault__ is a dentistry student in the 6th year at the Faculty of Dental Medicine in Strasbourg (France).

In recent years, the use of aesthetic bonded ceramic restorations has been favoured because of the aesthetic demand of our patients as well as our profession's concern to promote minimally invasive procedures[1]. Among these restorations, veneers are mostly associated to the aesthetic improvement of the smile and the techniques of tissue preservations[2].

The fragility and detachment of these fine pieces of ceramics remain the main sources of apprehension of practitioners despite excellent results reported in the many clinical studies published to date[3,4]. Admittedly, a low rate of failure is still relevant, but the understanding of the phenomena and the clinical criteria influencing the result either positively or negatively enabled to systematise the entire procedure in a better way. Among the criteria reported as determinants, the respect of an exclusive enamel bonding is essential. Indeed, the enamel can be easily etched and its composition, mainly mineral, does not make adhesion difficult as hydrated dentine can do. Hence, when the bonding system is wisely selected, the ceramic-enamel bond can reach adhesion values greater than the natural dentinoenamel junction.

In order to preserve the enamel tissue of the vestibular surfaces, several authors have proposed clinical procedures based on the analysis and preliminary composed aesthetic treatment plan. The use of silicone keys to control the reduction[5] to the transfer the treatment plan through a mock-up[6,7] are approaches that limit the preparation to the bare minimum. Then, the respect of a strict bonding protocol ensures the durability of the final result.

The purpose of this article is to illustrate the preparation and bonding of ceramic veneers using the light-curing composite cement G-CEM Veneer combined with its dedicated universal adhesive (G-Premio BOND).

Clinical evaluation and aesthetic project

The initial consultation enables to take note of the patient's wishes and to confront them with the clinical and radiographic criteria. The aesthetic therapeutic decision may depend on desires such as shape modification, colour alteration, restoration of a large caries or correction of malpositions. The clinical case described below relates to a patient with oligodontia and microdontia, eager to improve her smile and to overcome the lack of permanent posterior teeth. The initial analysis (Figure 1) shows a "childlike" appearance of the smile, characterised by small anterior upper teeth associated with the presence of several diastemas.

Fig. 1: The 45-year-old patient presented with oligodontia and microdontia, characterised by the presence of many diastemas in the smile. The distribution of the teeth on the arch has been optimised by the previous orthodontic treatment which enables to envision the realisation of ceramic facets. Front view of the smile (a), intraoral view of the smile (b) and occlusal view (c).

The aesthetic treatment plan resulting from the preceding analysis must allow effective communication with the patient as well as the dental technician. We found the use of a virtual project from a Photoshop Smile Design (PSD) approach ideal to fulfil both the communication to the patient and the technician (Fig. 2a). This way, the technician was able to carry out a preparatory wax-up (Fig. 2b, 2c), which was then transferred to the mouth through a mock-up of bis-acryl temporary resin. In this case, the PSD project made it possible to present the two treatment options to the patient: partial preservation of the central diastema or complete closure of the diastema. Our common preference was to partially preserve the central diastema.

Fig. 2: (a) The aesthetic analysis associated with an aesthetic project (smile design) enables the efficient guidance of the dental technician towards the construction of the desired wax-up. (b) The future gingival contour was drawn on the plaster (c) Then, it was covered by the modeling wax.

Enamel preparation

Once the mock-up was made, it served as a guide for the necessary gingivoplasty (Fig. 3a, 3b). After gingival healing, the preparation could be started. The use of techniques to guide the preparation depth is essential. To do this, specific burs allow the practitioner to maintain enamel for the bonding, as long as a depth of 0.4 to 0.8 mm is respected. Horizontal, vertical and cervical depth marks were prepared on the buccal surface of the teeth, before starting the preparation.

The cervical limit was placed juxta-gingivally to facilitate the placement of the rubber dam during the luting later on. The proximal limits connected below the contact point to position the dento-restorative joint in a non-visible area, regardless of the angle of view. The contact point was preserved at first and then faded by an abrasive matrix tape. Finally, the free edge was reduced when it was worn, altered or dyed.

The preparation was rounded and finished with a fine-grit bur (yellow coded), or even using sonic or ultrasonic instruments, to ensure a more reliable reproduction during the impression (Fig. 3c).

Fig. 3: (a) The mock-ups were made first to guide the surgical act of gingival recontouring. (b) The removal of these mock-ups then made it possible to finalise the gingivectomy around each tooth in order to optimise the future emergence profile. (c) After 21 days of healing, the controlled preparation technique through the mockups described by G. Gürel could be carried out, followed by the impression.

Try-in and luting

The aesthetic validation was done in the chair using the dedicated try-in pastes (G-CEM Try-In Pastes), allowing the practitioner to evaluate the possible impact of the colour of the cement on the final colour of the veneer (Fig. 4a, 4b). This criterium is particularly essential when the veneer is thin and/or made of feldspar ceramic without reinforcement[8]. When all the aesthetic criteria initially desired were respected, the restorations could be luted. Firstly, the intaglio surfaces of the glass ceramic veneers (reinforced lithium disilicate) were etched with hydrofluoric acid for 20 seconds, then rinsed and dried before being covered with a primer (G-Multi PRIMER) and left one minute minimum until evaporation.

Fig. 4: (a) After removal of the provisional veneers, the dental surfaces were cleaned before trying all veneers with G-CEM Try-in Paste. When veneers are thin (<0.6mm), the colour of the bonding resin can influence the aesthetic result. (b) It is interesting to do several glycerine fitting trials to judge the final result. Here, 11 was tried with a try-in paste "A2" while 21 was tried with a try-in paste "Bleach". The brightness of 21 was preferred and therefore chosen.

The placement of a rubber dam guaranteed isolation from ambient humidity and sulcular fluid. The dam was supplemented by a Teflon tape which ensured the protection of neighbouring preparations on which the different products could be deposited (Fig. 5a).

After rinsing the try-in paste away with water, an alumina micro-blasting guaranteed a cleaned surface and generated a macro-roughness, enhancing the adhesion (Fig. 5b).

The choice of the adhesive approach was based on scientific evidence concluding that the best adhesion values between enamel and ceramic are observed when the protocol includes enamel etching[9] (Fig. 5c).

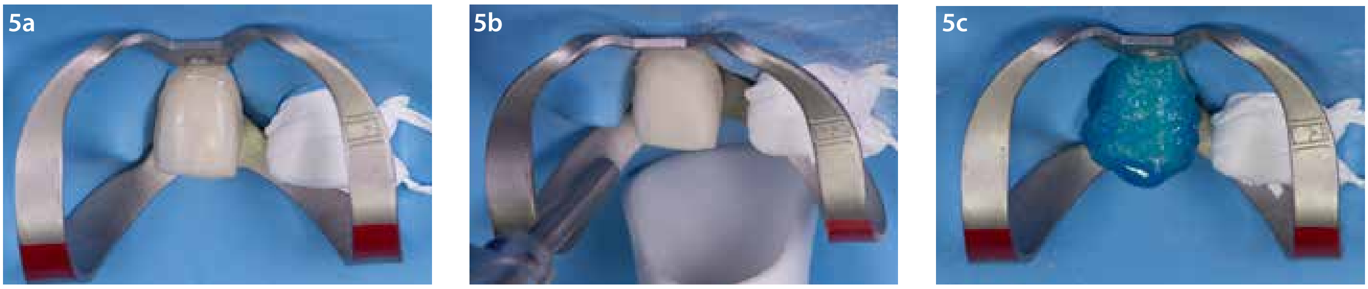

Fig. 5: (a) After rubber dam placement, the enamel of the prepared tooth was rinsed with water, to eliminate the water-soluble fitting paste. (b) Next it was sandblasted with alumina. (c) The surface was etched for 30 s with orthophosphoric acid, rinsed and dried.

The adhesive was scrubbed vigorously onto the enamel surface (Fig. 6a) before being spread by a strong dry air blow as recommended by the manufacturer. This step also contributes to the evaporation of the solvents contained in the adhesive. Finally, immediate light-curing of the hybrid layer obtained at this stage is strongly recommended (Figure 6b).

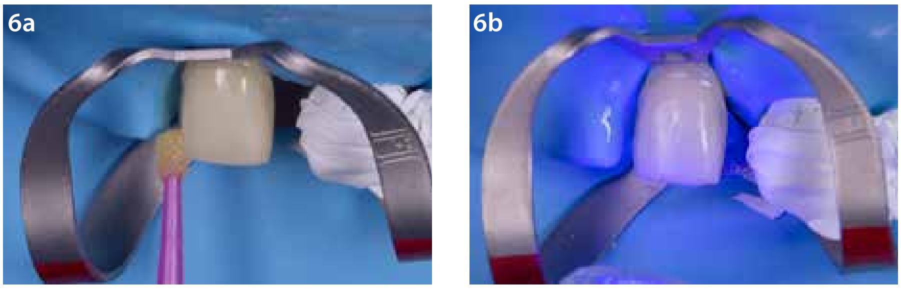

Fig. 6: (a) The universal adhesive G-Premio BOND was applied vigorously over the entire enamel surface, before being spread with oil-free air. (b) The adhesive was then immediately light-cured. Its low thickness (no more than 10 µm) does not pose any risk of difficulty to insert and seat the veneer.

References

1. Etienne O, Anckenmann L. Restaurations esthétiques en céramique collée. Paris: Editions CdP; 2016.
2. Etienne O. Facettes en céramique. Memento, editor. Paris: Ed. CdP; 2013.
3. Peumans M, De Munck J, Fieuws S, Lambrechts P, Vanherle G, Van Meerbeek B. A prospective ten-year clinical trial of porcelain veneers. The journal of adhesive dentistry. 2004;6(1):65-76.
4. Gurel G, Morimoto S, Calamita MA, Coachman C, Sesma N. Clinical performance of porcelain laminate veneers: outcomes of the aesthetic pre-evaluative temporary (APT) technique. Int J Periodontics Restorative Dent. 2012;32(6):625-35.
5. Belser U, Magne P, Magne M. Ceramic laminate veneers: continuous evolution of indications. J Esthet Dent. 1997;9(4):197-207.

Each veneer was thus bonded individually (Fig. 7a to 7c), starting with the central incisors, followed by the canines and finally the lateral incisors. The proximal contacts were checked and adjusted where necessary before each bonding.

When veneers are thin and made from a translucent material, it is interesting to prefer an exclusively light-curing resin cement, whose mechanical and aesthetic final properties outclass the dual cure resin cement in this indication. The perfect visualisation of the cervical cementation line immediately after the removal of the rubber dam enables the finishing with a sharp curette or a curved scalpel blade (Fig. 7d).

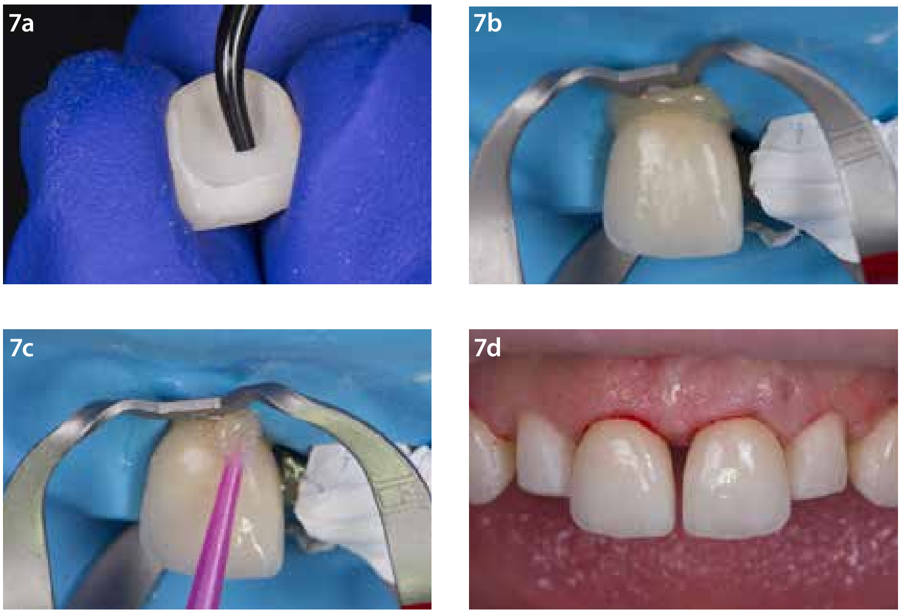

Fig. 7: (a) Each veneer was pretreated with hydrofluoric acid (20 s) and rinsed and dried before applying a coat of G-Multi PRIMER. After one minute, the veneer was dried and then coated with G-CEM Veneer light-cure resin cement in the selected colour. (b) It was positioned on the preparation before (c) removing the resin excess by wiping. This option made it possible to obtain an adhesive joint without microleakage unlike the tack-cure technique. The veneer was firmly held onto the tooth during the entire light-curing procedure. (d) When the six anterior teeth are involved in the treatment, the recommended sequence is to bond first 11 and 21, then 13 and 23, ending with 12 and 22.

A check-up after one week (Fig. 8) and six months (Fig. 9) assured the result and patient's satisfaction.

Fig. 8: After a week of healing, the periodontium refound its position. The redesigned gingival contours gave the illusion of a natural emergence profile.

Fig. 9: Result after 6 months.

6. Magne P, Belser UC. Novel porcelain laminate preparation approach driven by a diagnostic mock-up. J Esthet Restor Dent. 2004;16(1):7-16; discussion 7-8.
7. Gurel G. Predictable, precise, and repeatable tooth preparation for porcelain laminate veneers. Pract Proced Aesthet Dent. 2003;15(1):17-24.
8. Vaz EC, Vaz MM, de Torres EM, de Souza JB, Barata TJE, Lopes LG. Resin Cement: Correspondence with Try-In Paste and Influence on the Immediate Final Color of Veneers. J Prosthodont. 2018.
9. De Munck J, Van Landuyt K, Peumans M, Poitevin A, Lambrechts P, Braem M, et al. A critical review of the durability of adhesion to tooth tissue: methods and results. Journal of dental research. 2005;84(2):118-32.

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An efficient approach to the restoration of worn incisors

By **Dr. Florian Klumpp**, Germany

The injection moulding technique with resin composite is a semidirect restorative procedure that enables a predictable translation of the diagnostic wax-up into composite restorations[1]. While this technique requires a more elaborate preparation, this time can be recovered again in the finishing phase. Moreover, more attention can be given to the functional aspects of the restorations, which are crucial for the long-term result.

Case report

A 28-year-old male patient visited the dental clinic because he was dissatisfied with the appearance of his upper front teeth (Fig. 1). Clinical examination revealed the presence of an old composite restoration on tooth 11 and excessive incisal wear of all maxillary incisors and the canines, with dentine exposure on the incisal edges (Fig. 2).

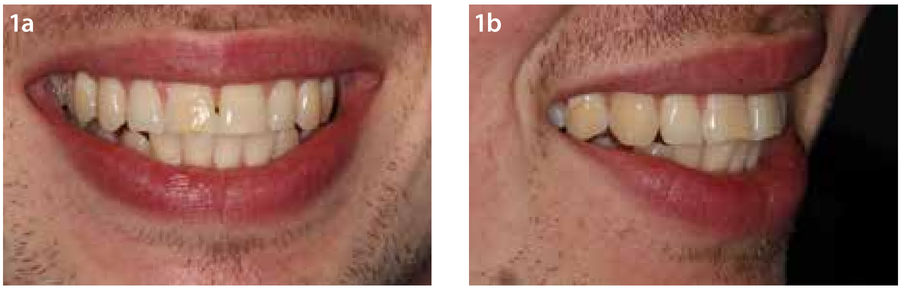

Fig. 1: Extraoral view of the initial situation. a) en face; b) oblique view. Note the excessive incisal wear

Fig. 2: Intraoral view of the initial situation

Fig. 3: Occlusal view of the mandible before treatment. Note the labioversion of tooth 41, which was triggering deflective interferences

Labioversion of tooth 41 caused a premature contact, triggering deflective interferences (Fig. 3). This was first corrected with a removable aligner.

Fig. 4: Tooth shade after bleaching

First, the teeth were whitened according to a home bleaching protocol with 6% hydrogen peroxide gel during 2-3 weeks to improve the shade and shade uniformity (Fig. 4).

When the diagnostic wax-up (Fig. 5) was created, the canines were shaped first and the canine guidance[2,3] was verified in the articulator. Owing to the disclusion during lateral and protrusive movements in this articulation pattern, the wear of the teeth is minimised, thus preventing recurrence of the excessive wear on the incisal edges.

Fig. 5: Diagnostic wax-up. a) vestibular view; b) palatal view

The diagnostic wax-up was copied using a clear vinyl polysiloxane (EXACLEAR, GC) in an unperforated, sectional impression tray (Fig. 6) to create a transparent mould. After setting, the silicone was removed from the tray and holes ending at the incisal edges of the incisors and canines were drilled. On both central incisors, an extra hole was drilled as an escape vent.

Fig. 6: a) A sectional nonperforated tray was filled with a clear vinyl polysiloxane (EXACLEAR). b) Creation of the transparent mould based on the wax-up

Before starting the procedure, the enamel and dentine shade of the teeth were determined with composite buttons (Essentia, GC) on the incisal and cervical third of the tooth, respectively, and with cross-polarised filtered images to remove the influence of the reflection (Fig. 7). This was done because it was planned to restore the incisal edge with a layering approach to give a very realistic appearance.

The old composite restoration on tooth 11 was removed. The teeth were etched and the adhesive was applied and cured in accordance with the manufacturer's instructions. The mould was seated and the composite (G-ænial Universal Injectable, shade A2) was injected (Fig. 8), tooth per tooth, and light-cured through the mould (Fig. 9). Sprue and excess were removed. It was not necessary to separate the teeth from each other, as the proximal surfaces were not involved and the transparent silicone key was fitting precisely, so overflow of the composite was avoided.

Fig. 7: Shade selection (Essentia) with the button technique and cross-polarising filter

Fig. 8: Injection of G-ænial Universal Injectable, shade A2

Fig. 9: Light-curing of the composite through the EXACLEAR mould

For the central incisors, the incisal part was cut back (Fig. 10) to embed various degrees of translucency and opacity in the incisal layer. A more distinct expression of the mamelons in those teeth fits the facial features of this patient and give a natural, young and vivid appearance. The adhesive procedure (etching and bonding) (Fig. 11) was repeated on the cut back part and the composite in the dentine shade that was initially selected (Essentia, shade MD) was used to create the mamelons (Fig. 12). Attention should be payed to obtain the correct thickness; a too thick dentine layer will make the result opaque and less natural, so make sure there is space left to place the enamel layer on top. On the other hand, if this layer is too thin, the effect will not be very visible and the restoration might look somewhat greyish. Thereafter, the selected enamel shade (Essentia, shade LE) was used to complete the vestibular surface (Fig. 13) and the restorations were finished. After rehydration, the teeth showed a good colour integration and surface gloss (Fig. 14). The palatal surfaces have an adequate morphology and sufficient concavity, without interference with the anterior closure path (Fig. 15). The extraoral view shows a natural and aesthetic overall appearance (Fig. 16) that satisfied the patient.

Fig. 10: The vestibular incisal part of the central incisors was cut back for the layering technique

Fig. 11: The bonding procedure was repeated on the cut back surface

Fig. 12: The mamelons of the central incisors were shaped (Essentia, shade MD) to mimic the natural anatomy of the tooth

Fig. 13: Restored vestibular surface of the central incisors (Essentia, shade LE)

Fig. 14: Intraoral view after rehydration

Fig. 15: The palatal surface show sufficient concavity not to interfere with the anterior closing path

Fig. 16: Extraoral view of the final restorations. a) en face; b) oblique view

In conclusion, this technique can be used as a minimally invasive and simplified treatment alternative. In this case, injection moulding was combined with a cut-back technique to obtain a young, lively appearance of the teeth, aesthetically fitting the patient in an optimal way. The reliable reproduction of the wax-up enables us to obtain an end result with a correct occlusion and guidance pattern in a relatively easy way.

References

1. Mehta SB, Francis S, Banerji S. A Guided, Conservative Approach for the Management of Localized Mandibular Anterior Tooth Wear. Dent Update. 2016 Mar;43(2):106-8, 110-2.
2. Ash MM and Nelson S. Wheeler's Dental Anatomy, Physiology and Occlusion. 10th ed. Philadelphia: Sounders Elsevier; 2015.
3. Klineberg I and Eckert S. Functional Occlusion in Restorative Dentistry and Prosthodontics. 1st ed. Maryland Heights: Mosby Ltd. Elsevier; 2015.

Considerations for optimal restoration of teeth with perforations

By **Georg Benjamin**, Germany

***Georg Benjamin** studied at the University of Würzburg (Germany) and the University of Umea (Sweden) from 2005 to 2010. He was assisting dentist in Brieselang in 2011 and 2012. Thereafter, in 2013, he became dentist at 'Endo Berlin Süd'. His work is focused on referral-based endodontic treatments. In 2015, he co-founded the dental blog www.saurezaehne.de, a digital collection of cases and dental topics, to share experiences with like-minded people. At the IDS 2019 he started the international clinical Dental Podcast "Dental Bonding".*

Perforations are an everyday complication that an endodontic practice has to deal with. Thanks to hydraulic silica cements, the prognosis for a perforation closure is good, but the question of how to optimally restore a tooth with perforation remains unanswered.

Case Report

A male patient visited the emergency service during the weekend because of pain in tooth 27. During the pulpectomy, the treating dentist had noticed that there was a particularly strong blood flow from one of the canals and had asked the patient to consult a dentist on Monday for follow-up. The family dentist diagnosed a perforation after X-ray inspection and referred the patient to our office.

Case Report

I made a cone-beam CT (Fig. 1 and Fig. 2) to better assess the extent of the perforation and the tooth was treated the same day. Due to the rotation of the tooth, compensated by the crown, the location of the palatal canal was much more distal than expected. The perforation was closed with a hydraulic silica cement (Fig. 3) and the root canals were prepared until 30.04. The canals were irrigated with NaOCl and provisionally closed (Fig. 4 and Fig. 5).

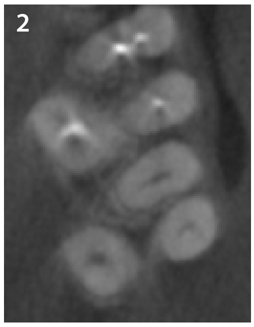

Fig. 1 and 2: CBCT of tooth 27

Fig. 3: The perforation was closed with a hydraulic silica cement

Fig. 4: The orifice was provisionally closed with a hygroscopic temporary obturation material and covered with blue flowable composite

Fig. 5: X-ray of the perforation closure after the first appointment

In the second appointment, as much excess as possible was removed from the fully set hydraulic silica cement (Fig. 6 and Fig. 7) and the dentine was sealed with G-Premio BOND before the NaOCl disinfection according to the "Immediate Endodontic Sealing (IES)" protocol[1], which is similar to the IDS protocol (Fig. 8). This universal adhesive should be dried with strong air pressure. It is ideal for deep endodontic cavities since pooling of the adhesive on the cavity floor is prevented.

Fig. 6: The hydraulic silica cement after complete setting

Fig. 7: Excess cement was removed as much as possible

Fig. 8: Dentine and cement sealed with G-Premio BOND

The root canal filling (Fig. 9 and Fig. 10) was melted away as deeply as possible in order to gain as much adhesive retention surface as possible in the following post-endodontic closure, followed by sandblasting with Al_2O_3 (Fig. 11). Next, everX Flow (Bulk shade) was used and closes a gap in my treatment protocol. The product flows very well bubble-free into the deep canal spaces and allows small root canals to be filled with a glass fibre reinforced material (FRC). In this case, it was used in the snow plow technique with the more viscous everX Posterior.

Fig. 9: Mastercones placed in the canal

Fig. 10: X-ray with Mastercones to confirm the determined working length

Fig. 11: Sandblasting before closure with everX Flow

Fig. 12: everX Posterior

Fig. 13: everX Flow, Dentin shade

Fig. 14: Essentia Masking Liner

everX Flow (Bulk shade) and everX Posterior allow the area of the perforation to be fully embraced and additionally stabilised in a way that would not be possible with a glass fibre post. Due to their bulk fill properties and the many small glass fibres, the polymerisation light is directed deep into the cavity.

To ensure an invisible closure of the crown, a layer of everX Flow in Dentin shade was placed on top of the layer of everX Posterior (Fig. 12 and 13). Using Essentia Masking Liner (Fig. 14) gives additional security to achieve an optimal value.

Fig. 15: Restoration with Essentia Universal

Fig. 16: Shaping and modeling with GC Gradia Brush

Fig. 17: Occlusion control

The crown was further restored with Essentia Universal (Fig. 15).
I used GC Gradia Brushes in combination with GC Modeling Liquid to shape the anatomical morphology (Fig. 16 and Fig. 17).

The different layers are clearly recognisable in the post-op radiograph (Fig. 18).

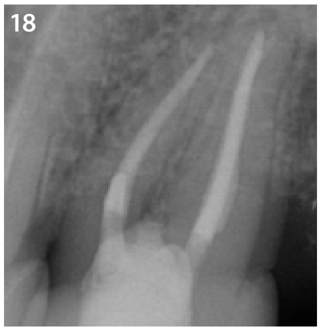

Fig. 18: Final X-ray inspection

Discussion

An FRC composite is more resistant to fracture than a conventional composite, due to simultaneous actions of several toughening mechanisms, such as crack deflection[2]. It stabilises the perforated tooth in a way that would not be possible with a fibre glass post. The entire pulp cavity is reinforced with this crack-inhibiting material. The physical properties of everX Flow are advantageous in a post-endodontic adhesive perforation closure.

References

1. De Rose L, Krejci I, Bortolotto T. Immediate endodontic access cavity sealing: fundamentals of a new restorative technique. Odontology. 2015;103:280-5.
2. Bijelic-Donova J, Garoushi S, Lassila LV, Keulemans F, Vallittu PK. Mechanical and structural characterization of discontinuous fiber-reinforced dental resin composite. J Dent. 2016;52:70-8.

Initial™ LiSi Press Contest: and the winners are…

From the 17th of September 2018 till the 1st of February 2019, GC Europe organised Initial™ LiSi Press Facebook contest. To be able to win one of the beautiful prizes, dentists were encouraged to upload their Initial LiSi Press case in the "GC Initial World" Facebook group with the hashtag #InitialLiSiPressContest. An international jury, led by MDT Michael Brüsch and Bill Marais, chose the winning cases that are shown below.

1st WINNER

Stephan van der Made (The Netherlands)

started his career as a goldsmith and gemstone cutter. He made a career switch to dental technology and graduated in 1996 as an all-round dental technician with the focus on crown and bridge works. In 2007, he founded Kwalident Dental Studio B.V., a laboratory specialised in ceramics, full rehabilitations and complex dental treatments. In 2018, he founded the course centre 'CUSP' to host international courses for dentist and dental technicians.

Marco Gresnigt (The Netherlands)

graduated Summa Cum Laude in 2005 at the university of Groningen, the Netherlands. In January 2012, he obtained his PhD on clinical and laboratory evaluation of laminate veneers. Besides working at the university, he works as a dentist in a centre for special care. Marco lectures at the Center for Dentistry and Oral Hygiene, where he is the current head of restorative dentistry and teaches master students in a specialised program on aesthetics and prosthetic dentistry. He works together with national and international researchers on studies and has published several articles on minimally invasive and adhesive dentistry in high-impact-factor dental journals. He obtained several international awards. Marco is a member of the international Bio-Emulation group.

This is a case of a young patient diagnosed with Amelogenesis Imperfecta. The patient was treated before with direct resin composite restorations in the anterior region to decrease the sensitivity of her teeth and to change the unattractive aspect of the affected enamel. The patient was unhappy with her teeth and felt social discomfort, therefore she asked for restorations with a brighter appearance.

Fig. 1: Initial situation at intake

Fig. 2: Intra-oral situation, it is clearly visible that some composites were made to improve the aesthetic appearance.

Fig. 3: Right side of the patient

Fig. 4: Left side of the patient

Fig. 5: Upper anterior jaw of the patient

Fig. 6: The surface aspect of the Amelogenesis Imperfecta is clearly visible

Fig. 7: Lower jaw

Fig. 8: After creating a digital smile design, the facial midline and inter-pupillary line were transferred to the model

Fig. 9: Full wax-up in MO with only 1mm increase in the vertical dimension of occlusion (VDO)

Fig. 10: End-to-end relation hindered the creation of a good interdigitation.

Fig. 11: Cast of the preparations.

Fig. 12: Minimal invasive preparations, only removing the imperfect enamel.

Fig. 13: Preparation guides were used to determine the final thickness of the crowns

Fig. 14: Preparation guides to show the amount of space between wax-up and preparation

Fig. 15: Full contour wax-up of the crowns

Fig. 16: Labial reduction in wax

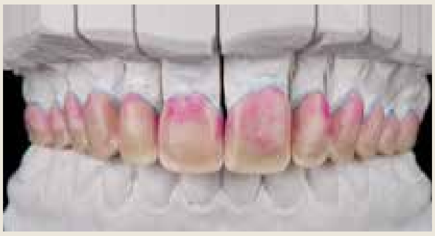

Fig. 17: Last occlusion check in wax

Fig. 18: Sprueing the wax model

Fig. 19: Sprueing the wax model

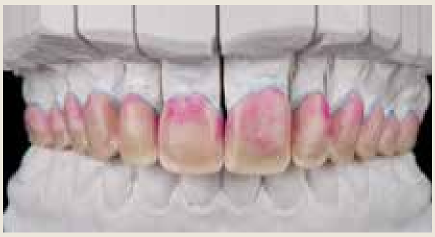

Fig. 20: Sprues attached to the sprue base

Fig. 21: Ready for investing

Fig. 22: Investment

Fig. 23: After pressing and cooling down

Fig. 24: Press results after divesting with glass beads.

Fig. 25: GC Initial LiSi Press MT B0

Fig. 26: Using a silicone guide to reduce the incisal part

Fig. 27: Incisal reduction

Fig. 28: Internal staining

Fig. 29: Powdering for wash fire

Fig. 30: Wash fire

Fig. 31: After the 1st bake an internal staining was done.

Fig. 32: After 2nd bake, surface finishing.

Fig. 33: Drafting compass was used to create symmetry in shape.

Figs. 34 – 35: Silver powder to check the surface microstructure.



Figs. 36 - 38. After glaze firing and polishing by hand.

Fig. 39: Posterior crowns are full contour lithium disilicate and finished with staining technique and glaze.

Fig. 40: 10 minimal prep veneers and crowns ready for placement.

Fig. 41: Extra-oral view, 1 month after placement

Fig. 42: Intra-oral view, 1 month after placement

Fig. 43: A much brighter yet still looking natural compared to the mandibular teeth (next phase).

Fig. 44: A very natural fluorescence in comparison to the little remaining enamel on the lower teeth.

Fig. 45: Ceramics with a natural appearance.

Good photographic documentation, interdisciplinary communication and proper treatment planning is giving a predictable and satisfying end result. The use of DSD in combination with silicon guides is very helpful. I am very pleased with the Initial LiSi Press system. It facilitates creating very nice fluorescent dentine and the beautiful opalescent ceramics make it more easy to create a natural translucency without making the end result look greyish.

2nd WINNER

Santiago García Zurdo (Spain)

was born in Madrid (Spain) in 1974. He completed his studies as dental technician in Opesa (Madrid) in 1992. With more than 20 years of experience in different laboratories, he opened his own dental laboratory in Madrid in 2012, focusing his work on dental aesthetics. He obtained the certificate of the Osaka Ceramic Training Center (Osaka, Japan) under the orders of Shigeo Kataoka in 2012. Santiago has been working in Germany (Bellmann-Hannker Dentallabor) in 2014. In 2016, he started implementing the eLAB protocol of Sascha Hein and became an eLAB instructor in 2018. He currently practices in a specialised private practice in Madrid.

It is always very easy to obtain predictable results and very satisfactory from the aesthetic point of view when we use GC Initial LiSi. When veneering lithium disilicate frameworks, the guidelines of the respective manufacturer must be respected. By means of a simple standardised build up technique, lifelike aesthetics can be reproduced.

Fig. 1: Pressed lithium disilicate structures (Medium translucency- MT A1).

Fig. 2: Dentine layering with internal effects (GC Initial LiSi) (Dentin A1, TM-05, EO-15, TO Opal, EOP-2, IN-44, IN-45, CT-23, E-58, E59, EO-15, EOP Booster).

Fig. 3: Result after first bake.

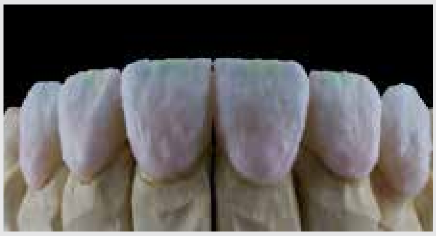

Fig. 4: Enamel layering (A1+TN, EOP-2, EO-15, E-58-E59).

Fig. 5: Enamel correction (EOP Booster-E59).

Fig. 6: Shape and texture.

Fig. 7: Final result.

3rd WINNER

Haluk Demir Taşdemir (Turkey)

graduated from Ilgaz Health College in 2008. In 2010, he graduated from Hacettepe University, Department of Dental Prosthesis Technology. He currently runs his dental laboratory in Istanbul (Turkey), providing services in the fields of aesthetic and implant dentistry.

An Initial Lisi Press crown was made to replace a single central incisor in our patient.

Fig. 1: Initial situation

Fig. 2: With the help of shade guides and photographs, the shade was determined

Fig. 3: A detailed colour analysis map was created

Fig. 4: MO Initial LiSi Press crowns with screw retention were made and characterised using a polychromatic layering technique. It was glued on the titanium base with G-CEM LinkForce (Shade: Opaque)

Fig. 5: The result was beautiful with intense colour, high value and natural translucency

Fig. 6: End result

G-CEM LinkForce™: A Simplified System for Adhesive Bonding Procedures

By **Dr. Antonio Saiz-Pardo**, Spain

Dr. ***Antonio J. Saiz-Pardo*** *obtained his degree in dentistry from the University of Granada (U.G.) in 1998. He also is a Master in Oral Surgery and Implantology, which he studied at the same university from 2001 to 2004. In 2012, he graduated "cum laude" as Doctor in Stomatology at the U.G. In 2013-2014 he was Associate professor with the Master of Oral and aesthetic rehabilitation at the University of Almería. He also holds diplomas in Esthetic Dentistry (2009) and Dental Clinic Management (2008). He is a member of ITI, SECIB, SEPA and EAED affiliate. He spoke at various in national and international congresses. He has published 16 articles and taught in various courses. He has been working in his private practice, surgery and implants in Jaén (Spain) since 1998.*

Luting procedures for indirect restorations should be simple. Nowadays, dentists continuously seek products that promote ease-of-use, efficiency, and simplicity for predictably placing indirect restorations. Luting is broadly defined as fastening, attaching, or sealing two components together (e.g. natural tooth structure and restorations). In dentistry, this can be accomplished either by cementation or adhesive bonding.

Cementation involves attaching a restoration to natural tooth structure by means of a cement in between the two. Mechanical retention and retention form are requisites for cementation. Conventional cements create a hardened layer that attaches restorations to underlying tooth structure, taking advantage of both adequate preparation design and resistance form. The cementation process is relatively straightforward and uncomplicated.

Contraindicated for use with glass-ceramic restorations, conventional cementation is appropriate in cases where the restorations are fabricated from high-strength ceramic materials (e.g., zirconia-, alumina-, and lithium

GC get connected / 43

disilicate-based), which typically demonstrate good mechanical properties and an ability to withstand occlusal forces without the use of adhesives. Note that high-strength ceramic materials may also be adhesively bonded. However, these restorations typically require a more radiopaque conventional cement in order to enhance differentiation from recurrent caries, as well as one that completely dual- or self-cures when placed in non-light transmitting areas.

Adhesive bonding in dentistry involves conditioning the enamel and/or dentin to create tags in the tooth structure for chemical and micro-mechanical attachment of the restorative material to the natural tooth. Technical precision during adhesive bonding procedures can have a greater impact on success and predictability than material selection, primarily because adhesive bonding involves multiple steps in the process (e.g., conditioning the tooth structure through etching, cleaning, conditioning with adhesive; preparing the internal aspect of the restoration) and is highly technique sensitive (e.g., proper isolation, ensuring thorough light transmission and depth of cure to the bonded interface).

Unfortunately, achieving simplicity when seating today's indirect restorations can be challenging due to the multiple factors that affect adhesive bonding, including the restorative materials from which restorations are fabricated. Some restorations, such as those fabricated from stacked feldspathic ceramic and pressed leucite glass ceramics – as well as partial coverage restorations – must be adhesively bonded. Other restorations fabricated from metal ceramic or alumina must be cemented, while other materials like zirconia and lithium disilicate can either be cemented or adhesively bonded.

Dentists are simultaneously pressured to remain cost-effective and lower their overhead and inventory. Yet, many adhesive products have required mixing and matching multiple components from various sized bottles, which itself could be unpredictable. In fact, the use of adhesive bonding agents and adhesive resin cements from different manufacturers, or those that require different curing methods (e.g., self-cure, light-cure, dual-cure), could lead to unpredictable bonding results.

As a result, many dentists are faced with the quandary of which adhesive to use in a given situation and with which restorative material. It can be challenging to determine which to use when based on such factors as the characteristics of the case, preparation design, required bond strengths, isolation feasibility, and the type of material used for fabricating the restoration(s). Ultimately, most dentists would prefer to use one universal system for their adhesive bonding needs.

A Simpler, More Predictable Solution

New adhesive resin cement materials introduced in recent years have the potential to simplify the delivery of indirect restorations and simultaneously reduce and/or eliminate many of the challenges clinicians face during the placement process. Among them is G-CEM LinkForce universal dual-cure adhesive resin cement.

G-CEM LinkForce is a single, three-component system that enables predictable and secure placement of all types of ceramic, resin, and metal-based inlay, onlay, crown, and bridge restorations, regardless of whether self-curing or light-curing is required. In fact, adhesive resin cements have been shown to be superior options for seating all-ceramic restorations.

G-CEM LinkForce is also indicated for the cementation of metal, ceramic, and fiber posts, and cast post and cores, as well as all-ceramic and composite veneers (up to 2 teeth). Its universal application includes permanent cementation of crowns and bridges on implant abutments. It can also be used with CAD/CAM milled hybrid restorations (e.g., CERASMART™ Force Absorbing Hybrid CAD/CAM Blocks). Components of the G-CEM LinkForce system include G-CEM LinkForce Resin Cement, a universal, dual-cure adhesive resin cement that achieves a strong bond in virtually all indications. The system also includes G-Premio BOND™, a universal adhesive bonding agent that can be used in self-etch, selective etch, and total-etch mode, even to metal abutments and composite resin core build-ups when light-cured; and G-Multi PRIMER™, which ensures stable chemical adhesion to the restoration surfaces, including ceramics, composites, precious and non-precious metals, hybrid ceramics, zirconia, alumina, and glass fiber posts. Contributing to the universal nature of the G-CEM LinkForce universal adhesive resin cement system is the G-Premio BOND Dual Cure Activator (DCA), which achieves high bond strengths and enables efficient self-curing when light-curing is not possible (e.g., luting posts in deep and dark canals). The activator's incredibly thin film thickness will not interfere with crown placement, helping to ensure an intimate fit between the restoration and the preparation. Additionally, the material's self-cure mode is ideal when cementing restorations that are thick, opaque, or located in areas that cannot confidently be thoroughly light polymerized.

Although research has shown that some resin cements demonstrate varying levels of discoloration, dual-cure resin cements may influence the esthetics

Clinical Protocol

When placing full-coverage ceramic restorations in the anterior (Figure 1), the following protocol is followed. The use of adhesive resin cements like G-CEM LinkForce requires meticulous isolation. The restoration surface (e.g., internal aspect of glass ceramics, lithium disilicate ceramics) must be etched with hydrofluoric acid, rinsed and dried.

1. After removing the temporary restoration, clean the preparation thoroughly.

2. Try in the restoration using the corresponding G-CEM LinkForce Try-in Paste.

3. Remove the restoration, then rinse the paste from the restoration with water.

4. After pre-treatment of the restoration with sandblasting or hydrofluoric acid etching, condition the internal aspect of the restoration with G-Multi PRIMER, then dry with an air syringe.

5. Rinse and dry the tooth preparation.

Figure 1. Preoperative view of a patient who showed up with a Class IV fracture of tooth #9. A full-coverage all-ceramic crown would be adhesively bonded using G-CEM LinkForce universal dual-cure adhesive resin cement.

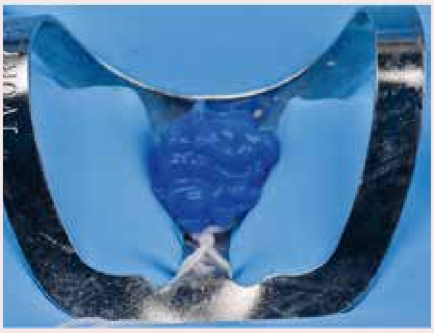

Figure 2. In this case, the preparation for the full-coverage crown restoration was etched using a total-etch technique; the G-Premio BOND universal adhesive bonding agent promotes predictable bonds with all etching modes.

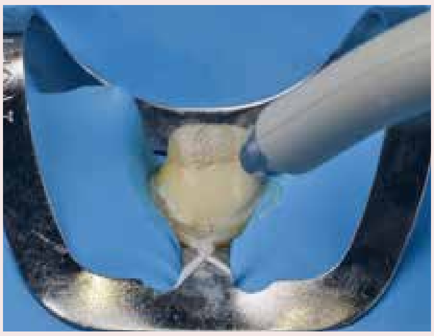

Figure 3. G-Premio BOND universal adhesive bonding agent was applied to the preparation, then allowed to sit for 10 seconds before being air dried with maximum air pressure for 5 seconds.

of restorations. Fortunately, unlike other dual- and self-cure cements that are prone to color shifts over time, G-CEM LinkForce is color stable and demonstrates tooth-like fluorescence for optimized esthetics. Additionally, the universal dual-cure adhesive resin cement is available in four shades (i.e., A2, Bleach, Opaque, Translucent), along with corresponding try-in pastes, to accommodate a variety of esthetic cementation requirements. G-CEM LinkForce also enables easy clean-up of excess cement from restoration margins when tack-cured for 2 to 4 seconds. By promoting the atraumatic removal of excess adhesive resin cement from gingival and interproximal areas, G-CEM LinkForce further helps to ensure long-term treatment functionality.

6. Select from three etching techniques: self-etching, selective etching, or total etching, and etch the preparation accordingly, then rinse and dry (Figure 2).

7. Apply G-Premio BOND universal adhesive bonding agent to the preparation, and allow to sit for 7 seconds, then air dry for 5 seconds (Figure 3). Light-cure the adhesive for 10 seconds (Figure 4).

8. Extrude G-CEM LinkForce universal dual-cure adhesive resin cement directly into the restoration (Figure 5), immediately seat the crown onto the prepared tooth, and maintain pressure (Figure 6).

9. Tack cure the restoration for 2 seconds, which will facilitate easier removal of excess resin cement.

10. Light cure the restoration from each surface/margin for 20 seconds.

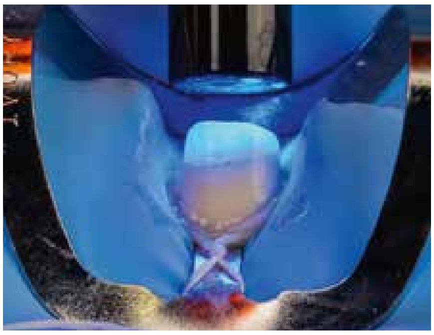

Figure 4. The G-Premio BOND universal adhesive bonding agent was then light-cured for 10 seconds.

Figure 5. G-CEM LinkForce universal dual-cure adhesive resin cement was extruded directly into the internal aspect of the full-coverage crown restoration.

Figure 6. The full-coverage crown was immediately seated onto the preparation, and pressure was maintained to allow extrusion of excess cement.

Figure 7. Postoperative view of the full-coverage restoration seated with G-CEM LinkForce universal adhesive resin cement.

Quiz

1. Why is it difficult to achieve simplicity when seating today's indirect restorations?

a. The various types of restorative materials available influence adhesive bonding and cementation.
b. Technical precision during adhesive bonding procedures.
c. Using adhesive bonding agents and adhesive resin cements from different manufacturers, or that require different curing methods, could lead to unpredictable bonding results.
d. All of the above.

2. What are some of the advantages of using universal dual-cure adhesive resin cement like the G-CEM LinkForce system?

a. Dentists can remain cost-effective and lower their overhead and inventory.
b. It can be used for all adhesive bonding needs, regardless of whether self- or light-curing mode is needed, and regardless of whether a self-etch, total-etch, or selective etch adhesive bonding protocol is desired.
c. Both a and b.
d. None of the above.

3. The self-cure mode of universal adhesive resin cements like G-CEM LinkForce is ideal under which of the following conditions?

a. When cementing restorations that are thick or opaque.
b. When restorations are placed in locations that cannot be confidently light polymerized.
c. Both a and b.
d. None of the above.

4. G-CEM LinkForce is different from other resin cements and dual-cure resin cements in terms of esthetics because it is color stable and demonstrates tooth-like fluorescence, whereas other dual- and self-cure cements are prone to color shifts over time.

a. True
b. False

5. Which of the following is not a characteristic of G-CEM LinkForce dual-cure universal adhesive resin cement?

a. It produces predicable and secure bonding, regardless of whether self-curing or light-curing is required.
b. It cannot be used for resin-based restorations.
c. It achieves high bond strengths and enables efficient light-curing.
d. Its universal application includes permanent cementation of crowns and bridges on implant abutments.

1.d 2.c 3.c 4.a 5.b

Notes

Notes

Notes

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