3M Science. Applied to Life.™

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Espertise™ Magazine

Dear Reader,

Currently, there is a lot of exciting developments happening at 3M: The new corporate brand platform 3M™ Science. Applied to Life.™ was introduced in spring 2015 and the 3M℠ Health Care Academy was founded. Most recently, the company has announced the formation of 3M Oral Care, combining the former 3M ESPE Dental and 3M Unitek Orthodontics into a single new division. The idea behind this is to leverage the fundamental strengths of the company in science and innovation to deliver a complete suite of solutions across the continuum of oral care.

Take the opportunity to learn more about the latest innovations regarding the company 3M and its dental products, many of which will be presented in this issue of the Espertise™ Magazine.

Enjoy reading!

Content

Bulk fill materials – just a trend?

Barbara Cerny, 3M Oral Care, Seefeld, Germany

Participants of the 3M-sponsored symposium.

On the occasion of the 47th Meeting of the Continental European Division of the International Association for Dental Research (CED-IADR) in Antalya, Turkey, a 3M-sponsored symposium with the title "Bulk fill materials – just a trend?" took place on October 15, 2015. We had a conversation with one of the chairmen of this symposium, Prof. Dr. Reinhard Hickel (University of Munich), about the suitability of the innovative materials for everyday use in the dental office.

Prof. Dr. Hickel, what is your opinion: are bulk fill materials just a short-term trend or are they here to stay?

Bulk fill materials are already widely accepted by dentists around the globe. The fact that they are used in a great and steadily increasing number of practices on a regular basis shows us that the development is definitely more than just a short-term trend. This assumption is supported by the fact that numerous dental manufacturers are involved in the development of their own bulk fill materials. They are finally making significant investments in research and development of resin-based composites again.

Is there a gain for the dental practitioner resulting from the availability of the new restoratives?

In my opinion, the innovative products are useful for standard restorative treatment in the posterior region, where they contribute to a simplified, time-saving procedure in particular when costs are limited. According to my own clinical experience and initial studies, good results are achieved and the success rates are similar to those of traditional dental composites. The in-vitro study results presented during this symposium give reason to expect a good clinical performance as well: The tested bulk fill materials show a relatively low shrinkage and shrinkage stress, while the mechanical properties of many products are similar to those of other conventional composite materials.

The speakers Dr. Will Palin (Birmingham) and Dr. Cees Kleverlaan (Amsterdam) and the chairmen Prof. Dr. Reinhard Hickel (Munich) and Prof. Dr. Bart Van Meerbeek (Leuven).

Despite the wide acceptance of bulk fill materials, some potential users are afraid that an incomplete cure of the material or an insufficient marginal adaptation might lead to clinical problems. Is this a legitimate concern?

In order to ensure a complete cure of bulk fill materials, it is even more decisive than with traditional composites to use a high-performance curing light. This was confirmed by investigations of the Academic Center for Dentistry Amsterdam (ACTA), the Netherlands, which were presented during the symposium. As a matter of course, it is also decisive that the user adheres to the manufacturer's recommendations regarding the polymerization time etc. Respecting this, a complete cure can be obtained. Due to reduced shrinkage stress, the marginal adaptation of the materials is usually good.

What was your overall impression of the 3M-sponsored symposium?

The two speakers from the University of Birmingham (UK) and the ACTA gave pointed lectures that showed lots of scientific data on the performance of bulk fill materials. I hope that I was able to add to the picture by summarizing the findings of the University of Munich in place of Prof. Dr. Karl-Heinz Kunzelmann. Altogether, the presented data revealed that bulk fill materials are an interesting development suitable for practical use, with some promising characteristics. I already look forward to knowing the next steps in the evolution of the materials and in particular to seeing the results of clinical studies.

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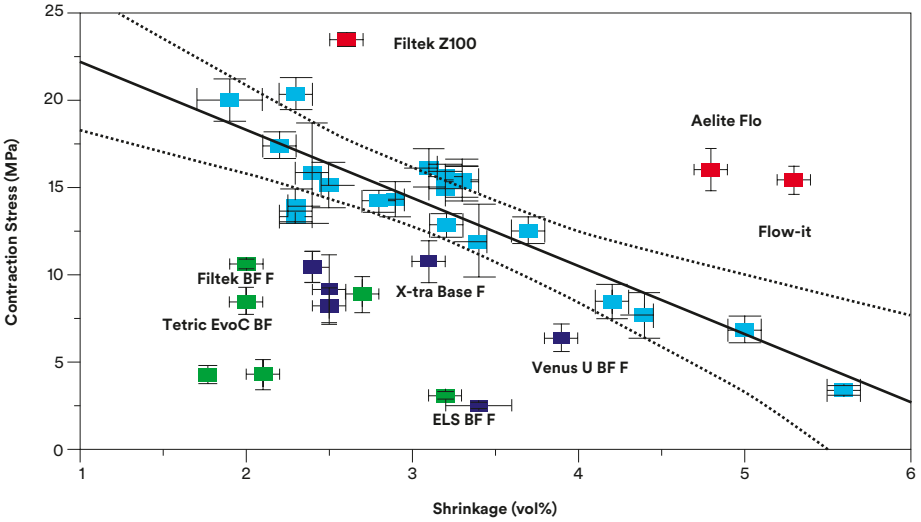
Bulk fill materials and their polymerization in the dental office

Cees Kleverlaan, Academic Center for Dentistry Amsterdam, the Netherlands

In the evolution of dental composite materials, an improvement of the material properties was achieved mainly by modifications of the filler composition and sometimes by variations in the matrix chemistry[1]. One of the main aims has always been a reduction of polymerization shrinkage and the associated stress development that might cause clinical problems.

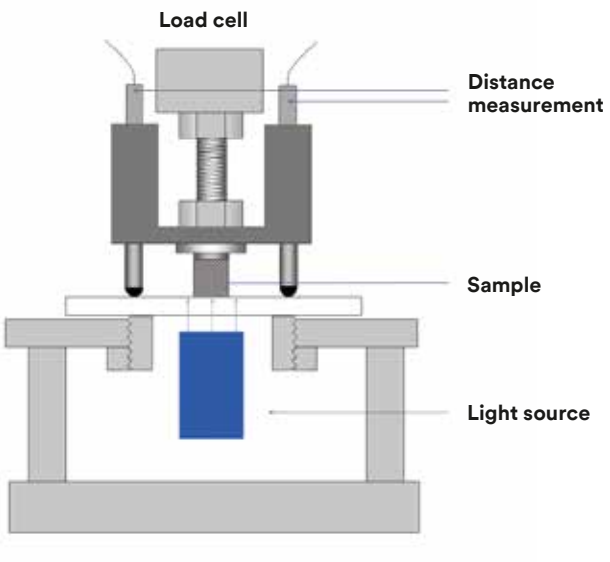
After several years without groundbreaking news in the field of composite development, the launch of the first "bulk fill" materials set the ball rolling again. Numerous manufacturers pursued the goal of reducing polymerization stress even further to allow for composite placement in layers with increased (4 to 5 mm) thickness in the posterior region. The first available material was a flowable composite that required an occlusal layer of traditional material to obtain the required stability. Lately, bulk fill materials with a higher filler load were introduced. Their mechanical properties are well in the range of other resin-based direct restoratives.



Curing contraction versus contraction stress of five different bulk fill composites (blue dots) together with previously published data (Kleverlaan C.J. and Feilzer A.J. Dental Materials (2005) 21, 1150–1157) showing that the curing contraction and contraction stress of the bulk fill composites are lower than most standard Bis-GMA based composites (cyan dots).

Shrinkage and shrinkage stress

In order to evaluate the shrinkage stress of the new materials, an in-vitro test was carried out in Amsterdam. The curing contraction and contraction stress occurring in mesial-occlusal-distal restorations and in a completely rigid situation was measured.



Experimental setup for the measurement of contraction stress.

The results showed that the flowable bulk fill materials tested exhibit a relatively low shrinkage and stress. This shrinkage does not occur immediately when light curing is initiated, but with a certain temporal delay. According to the results of another investigation, water uptake after polymerization[2] compensates for the material deflection caused by shrinkage and stress. Thus, the initial stress is eliminated over time. The speed of water absorption was similar for all tested materials.

Interesting information about the performance of curing lights in the practice environment was obtained from a survey carried out in different dental offices[3] in the Netherlands checking curing lights. It turned out that all devices worked and performed well at 0 mm distance according to the ISO norm, but most showed inadequate results at distances of more than 10 mm. Only four devices (including 3M™ ESPE™ Elipar™ S10 LED Curing Light, which can be the distance between the lightguide and the bottom of a box.) met the criteria of 300 mW/cm² at 10 mm distance.

According to the results of the above-mentioned studies, the shrinkage, shrinkage stress, and water sorption of bulk fill materials are similar to conventional composites used in the dental practice. Clinical studies are needed to confirm the in-vitro results.

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The effect of increment thickness on the polymerization stress of bulk fill materials

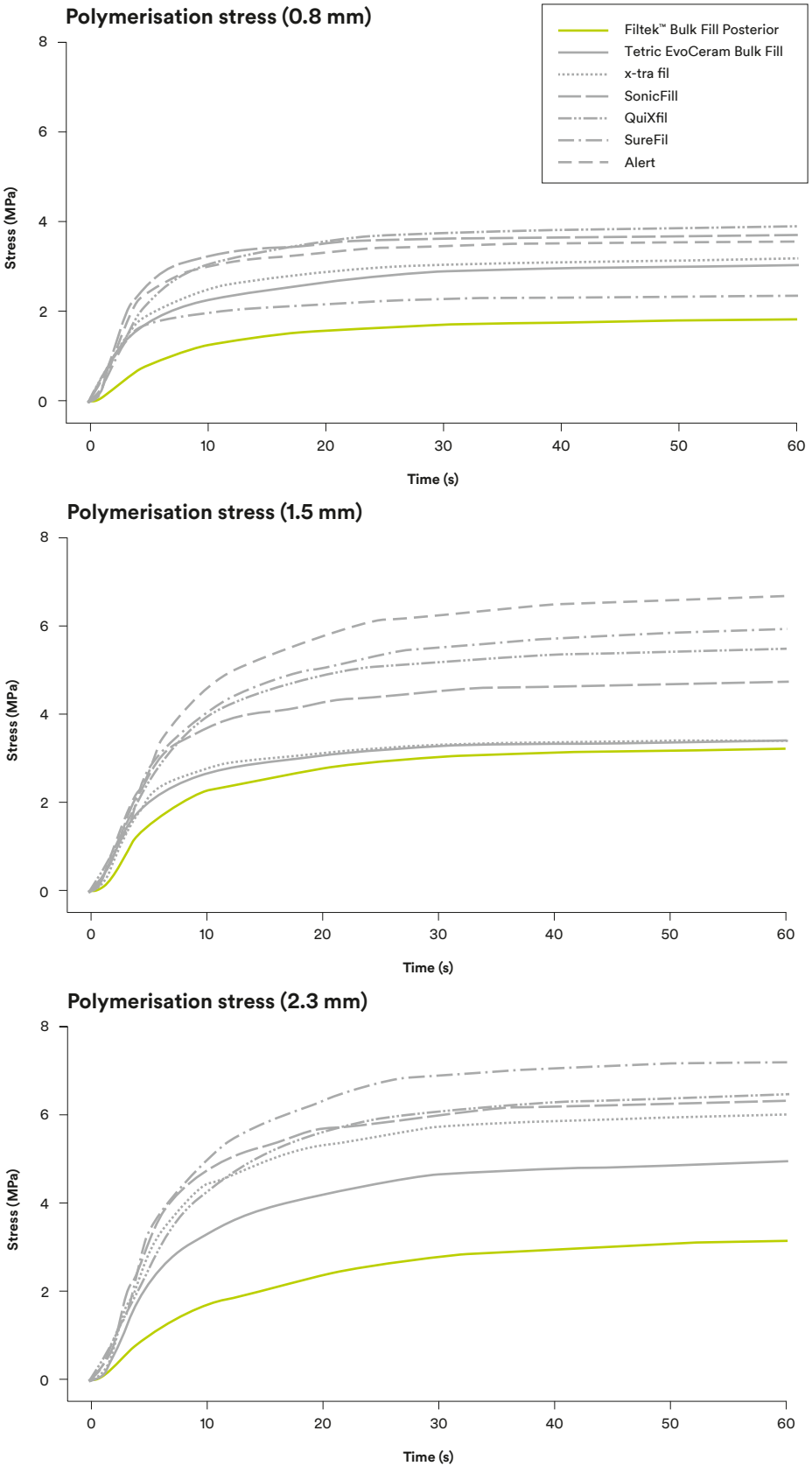
Will Palin, University of Birmingham and David Watts, University of Manchester, United Kingdom

Bulk-fill resin-based composite technology is not an entirely new development. However, it has seen a recent resurgence, enhancement and rapid increase in popularity by dental practitioners over the last five years. Success of these material types is driven by dentists' demand for decreasing surgery time and improved convenience over an incremental layered approach used with conventional direct restoratives.[1] The current key features of "bulk-fill" materials include 1) increased depth of cure, ideally to at least 4 mm, 2) reduced shrinkage and/or stiffness in attempt to decrease associated polymerisation stress, 3) the use of either flowable or higher viscosity formulations, and 4) the use of higher translucency or more pigmented versions. Flowable or more translucent shades require 'capping' with a regular higher viscosity composite for sculpting and finishing the occlusal surface, improvement of mechanical properties and aesthetic quality of the restoration.

Relevance of minimizing shrinkage stress

Reduced shrinkage formulations, or more importantly, those that result in minimal shrinkage stress, are a key design challenge given the substantially higher curing volume compared with that of conventional incremental placement protocols. Minimizing stress generated by bulk-cured resin composites may provide improved marginal integrity at the tooth-restoration interface and superior clinical longevity.

To explore the effect of material thickness on polymerization stress of traditional resin composite materials and modern bulk-fills, an in-vitro study was conducted at the University of Birmingham School of Dentistry in collaboration with the University of Manchester. A traditional material with high filler content (low shrinkage: SureFil™ High Density Posterior Restorative, Dentsply; Alert™ Condensable Composite, Pentron), a traditional deep-curing formulation (high translucency: QuiXfil™,



Polymerisation stress for increasing specimen thickness (0.8 to 2.3 mm) and mass (0.1 to 0.4 g).

entsply) and four modern bulk-fills (Tetric EvoCeram® Bulk Fill, Ivoclar Vivadent; x-tra fil, Voco; SonicFill™ Sonic-Activated Bulk Fill Composite, Kerr; 3M™ ESPE™ Filtek™ Bulk Fill Posterior Restorative) were tested.

Stress measurement

The 'Bioman' device was used to evaluate the generation of shrinkage stress throughout and following cure of each material (n=3) at increasing thickness and material mass. Both the holding rod and 3 mm thick glass plate surface were grit-blasted with 50 µm alumina particles. The compliance of the device remains constant throughout testing (~6 µm/MPa). To consider shrinkage stress data that corresponds to a higher stiffness load cell and lower compliance (that might be expected in tooth cavities that have less compliance and generate more composite shrinkage stress), as previously established, a correction factor of x4 was used. A 3M™ ESPE™ Elipar™ S10 LED Curing Light was used to polymerise each specimen for 20 s at an irradiance of 767 ± 1.6 mW/cm^2.

Results

As the material thickness was increased, a greater mass of material would be expected to generate more stress (notwithstanding some offset by lateral stress relaxation for thicker specimens). Generally, shrinkage stress for a given resin composite increased with sample mass (specimen thickness) although there was a less observable effect with Filtek Bulk Fill Posterior.

The traditional material Alert could not be measured at 2.3 mm thickness without cohesive fracture in the glass plate, presumably as a result of substantially higher levels of shrinkage stress.

Material	Polymerization Stress at 60 s (MPa)		
	0.8 mm	1.5 mm	2.3 mm
Filtek™ Bulk Fill Posterior	1.8 (0.2)	3.2 (0.8)	3.1 (0.9)
Tetric EvoCeram®	3.0 (0.1)	3.4 (0.4)	4.9 (0.1)
x-tra fil	3.2 (0.2)	3.4 (0.2)	6.0 (0.7)
SonicFill	3.7 (0.1)	4.8 (0.2)	6.2 (0.4)
QuiXfil	3.9 (0.4)	5.5 (0.8)	6.5 (0.5)
SureFil	2.4 (0.8)	5.9 (0.2)	7.2 (0.5)
Alert	3.6 (0.4)	6.7 (0.7)	–

Polymerisation stress at increasing specimen height.

As shown in the Figures, the plots of stress versus time for Filtek Bulk Fill Posterior exhibited a lower gradient and therefore a reduced shrinkage stress rate at early stages of the curing reaction compared with other commercial materials. Moreover, the data shown in the Table reveals that Filtek Bulk Fill Posterior exhibited lower trends of stress generation for the thickest specimens even compared with other competitor bulk-fill materials. This phenomenon is likely to be attributed to the novel patented addition-fragmentation chemistry that allows stress relief as the polymer network grows.

Mechanism

According to 3M, Filtek Bulk Fill Posterior contains a new addition-fragmentation monomer (AFM) that changes the polymerization reaction. In conventional composite materials, stress occurs as a result of a polymer network[2] being formed during light curing: monomer chains spread from the irradiated surface deeper into the material. Highest shrinkage stress occurs where the network begins to form, caused by an increased rigidity and decreased volume.

With AFM, network formation is prolonged and the network is more evenly distributed throughout the whole composite layer due to an additional reactive site that enables cleavage of the molecular chains. The network relaxes and cross-links again at a later stage, causing reduced stress.

Conclusion

Although the clinical relevance of in vitro data should be interpreted with caution, the current results suggest that the use of Filtek Bulk Fill Posterior Restorative provides reduced polymerization stress at increased material thickness. This property may assist in reducing gap formation at the restoration margins whilst curing in bulk.

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The simple way of creating direct posterior restorations

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Direct composite restorations in the posterior region enjoy great popularity. However, in this region, the restoration has to withstand high masticatory forces so that a high long-term stability of the tooth-restoration system has to be ensured. Important preconditions are well-balanced mechanical properties and low polymerization shrinkage and stress to prevent microleakage and other negative clinical effects that might cause restoration failure. In order to minimize shrinkage stress, composite materials are usually applied in layers with a maximum thickness of 2 mm. This process is not only time-consuming, but also challenging and error-prone especially in areas with limited access and visibility (e.g. deep cavities). Here, the use of the innovative 3M™ ESPE™ Filtek™ Bulk Fill Posterior Restorative has proven its worth: It can be applied and thoroughly light-cured in layers of up to 5 mm thickness. The use of the new product is demonstrated using the following patient case.

Figure 1: Porous dental amalgam filling on the upper left first premolar. The second premolar is restored with composite and an additional cement filling that shows an infraction.

Figure 2: Situation after removal of the two functionally insufficient direct restorations and caries excavation performed under rubber dam isolation.

Figure 3: In order to restore the second premolar first, a metal matrix band is fixed with a wedge and a 35% phosphoric acid applied for 15 seconds.

Figure 4: Conditioning of the tooth surface with 3M™ ESPE™ Scotchbond™ Universal Adhesive. It is rubbed in for 20 seconds, air-dried and light-cured for 10 seconds.

Figure 5: The slight irregularities on the cavity floor are levelled with a thin layer of 3M™ ESPE™ Filtek™ Supreme Flowable Restorative that is applied and light cured.

Figure 6: A single layer of the innovative composite material, 3M™ ESPE™ Filtek™ Bulk Fill Posterior Restorative, shade A2, is dispensed into the cavity.

Figure 7: The use of capsules allows for easy void-free application from the bottom to the top of the cavity. Complete polymerization is ensured for layers of up to 5 mm.

Figure 8: Modelling of the non-sticky composite material that offers easy sculptability and stability at the same time. It stands out particularly due to its great adaptation to the cavity walls.

Figure 9: Situation after polymerization and removal of the matrix. A harmonic transition between the filling material and the tooth structure is already visible prior to finishing.

Editor's remark: Please follow the instructions for use applicable to the products being used.

Figure 10: Upper left second premolar after finishing and polishing with 3M™ ESPE™ Sof-Lex™ Spiral Finishing and Polishing Wheels.

Figure 11: Situation after placement of the metal matrix band around the upper left first premolar. The cavity is etched with a 35% phosphoric acid.

Figure 12: Application of the bulk fill material into the cavity after adhesive pre-conditioning. In this case, two work steps are needed to build up the tooth.

Figure 13: In the first step, the interproximal wall is created. The material is formed with a modelling instrument before the layer is light cured.

Figure 14: Situation after application of the second, bulk layer of composite into the cavity. The occlusal surface is ready for modelling.

Figure 15: A natural three-dimensional fissure morphology has been created without effort and the restoration is ready for the finishing process.

Figure 16: Use of a diamond instrument (Composhape, Intensiv) in the first finishing step in order to contour the restorations.

Figure 17: Use of the beige-coloured 3M™ ESPE™ Sof-Lex™ Spiral Finishing and Polishing Wheel with a fine grid for smoothening and removal of scratches.

Figure 18: High-gloss polishing of the restorations with the white spiral wheel (superfine grid). Due to the flexibility of the wheels, access to all areas of the restorations is easy.

Figure 19: Result of the repair process on the second premolar and the replacement procedure on the first premolar: The restorations have a natural appearance.

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Quickly obtained post-and-core restoration

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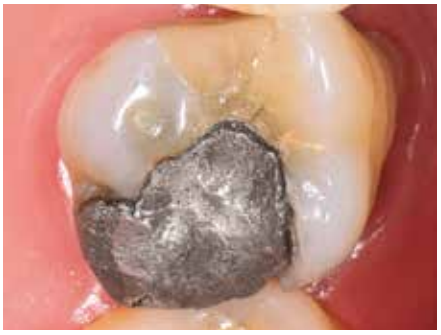

Figure 1: Preoperative view: Endodontically treated maxillary first molar with old amalgam and resin restorations that need to be replaced.

Figure 2: After removal of the existing restorations, an old liner is kept to indicate the entrance to the pulp chamber to facilitate the pre-endodontic build-up.

Figure 3: Application of 3M™ ESPE™ Scotchbond™ Universal Adhesive after selective etching of the remaining enamel surfaces.

Figure 4: Pre-endodontic build-up accomplished with 3M™ ESPE™ Filtek™ Bulk Fill Posterior Restorative.

Figure 5: After removal of the old liner, it becomes evident that only a palatal root canal filling exists.

Figure 6: Clinical situation after mechanical preparation of the four existing root canals.

Figure 7: Root canal fillings obtained using a warm gutta-percha obturation technique that creates a dense three-dimensional obturation and seal of the root canal system.

Figure 8: Use of a slim periodontal ultrasonic tip in a dry mode for initial gutta-percha removal. The tip also serves as a guide for the final drill of the fiber post system.

Figure 9: Fitting of the fiber post and length assessment. The selected post is a new 3M™ ESPE™ RelyX™ Fiber Post 3D with a unique 3D design and micro-retentions.

Editor's remark: Please follow the instructions for use applicable to the products being used.

Figure 10: Cleaning of the post surface with alcohol.

Figure 11: Direct application of 3M™ ESPE™ RelyX™ U200 Self-Adhesive Resin Cement into the root canal from the bottom to the top using a slim endo tip.

Figure 12: Post placed into the palatal root canal. Due to the micro-retentions of the new fiber post, no additional silane coupling agent is required.

Figure 13: Application of 3M™ ESPE™ Scotchbond™ Universal Adhesive to establish a strong bond of the core build-up material.

Figure 14: Dispensing of 3M™ ESPE™ Filtek™ Bulk Fill Posterior Restorative into the cavity. Due to the bulk fill options that allows for layers of up to 4 mm thickness, this procedure is completed very quickly.

Figure 15: Final core build-up restoration: The selected filling material ensures that a complete cure is obtained despite the increased layer thickness.

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Anterior aesthetics: A laboratory case study

Nicola Redase, Sydney, Australia

Over the past two years, I have worked closely with two prosthodontists, and become aware of the benefits associated with the clinical use of composite resin. I wanted to explore the simplicity of clinical composite material, specifically 3M™ ESPE™ Filtek™ Supreme XTE Universal Restorative, for use in an indirect technique. For this laboratory case study an impression from a real clinical case was used. The case had minimal preparation veneers and required a high aesthetic result.

Composite has an excellent capacity to bond with natural enamel. As a technician though, managing the colour and shape at every step of the build is essential to allow creation of an excellent final result. I used a layering technique in order to maximize the translucent effect within the minimal space available. Because our laboratory and clinic use the same material, modifying the shape or colour of the restoration in situ is easy. Teamwork is essential to maximize the simplicity and versatility of the material.

Figure 1: Model without restoration. The model has to be poured and trimmed accurately in order to preserve all the small details necessary for an aesthetic result.

Figure 2: Real work space with the dies in position. It is essential to visualize the morphology of the central incisors that will be in harmony with the other teeth.

Figure 3: A red pencil is used to draw the preparation margin and all surfaces are treated with 3M™ ESPE™ Sinfony™ Model Isolation Liquid.

Figure 4: 3M™ ESPE™ Filtek™ Supreme XTE Universal Restorative in the shade CT is used to build up the cervical part and body until 80 percent of each die is covered.

Figure 5: In order to create a solid dentin effect in the central part, composite material in the shade A2D is placed in the body and thinned towards the incisal edge.

Figure 6: A small portion of 3M™ ESPE™ Filtek™ Supreme XTE Universal Restorative in the shade A1D is used over the top to keep the value high in the thick area.

Figure 7: Using a thin layer of 3M™ ESPE™ Filtek™ Supreme XTE Universal Restorative in the shade A2D, a lovely warm effect is created in the body part.

Figure 8: Incisal effects like small mamelons are created by application of 3M™ ESPE™ Filtek™ Supreme XTE Universal Restorative in the shade A1D.

Figure 9: A gentle internal staining effect is achieved by application of 3M™ ESPE™ Sinfony™ Magic Stains.

Figure 10: A thin layer of transparent composite material (shade CT) is applied on top of the stained surface for an ideal optical effect.

Figure 11: The interproximal area is built up with 3M™ ESPE™ Filtek™ Supreme XTE Universal Restorative in the shades W and CT applied over the central portion.

Figure 12: The anatomical shape of the two central incisors is completed with 3M™ ESPE™ Filtek™ Supreme XTE Universal Restorative A3E.

Figure 13: Overview of the different shades of 3M™ ESPE™ Filtek™ Supreme XTE Universal Restorative and instruments used for the present case.

Figure 14: The surfaces of the restorations are brushed with water (oil is suitable as well) to evaluate the surface texture. At this point, it is most important to focus on the value.

Figure 15: Using a wax pencil, the interproximal transition area and the texture line are marked on the surface of the anterior restorations.

Figure 16: Before starting the finishing and polishing process, the contact points and occlusion are checked on the model and adjusted.

Figure 17: Result after polishing of the restorations with 3M™ ESPE™ Sof-Lex™ Spiral Finishing and Polishing Wheels. Alternatively, diamond paste may be used.

Figure 18: A highly natural optical appearance is obtained with the described indirect technique.

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3M Oral Care: Its contribution to evidence-based dentistry

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Due to continuous innovation, dental professionals often face the task of deciding whether a material or device is worth being integrated into their office. In the decision-making process, scientific evidence should be taken into account. However, the practitioner has to be aware of the fact that there are differences in the validity of evidence. The following hierarchy of evidence levels reported by the Agency for Health Care Policy and Research (AHCPR) in the U.S. (U.S. Department of Health and Human Services, 1992) is commonly accepted:

The hierarchy of evidence

1.	Systematic review of multiple, multi-centre, prospective, randomised controlled trials (RCT)
2.	Well conducted, double-blind, prospective RCT
3.	Well-designed clinical trials, possibly longitudinal, but without randomisation (Cohort)
4.	Well-designed clinical trials that are cross-sectional
5.	Matched case-controlled studies
6.	Well-designed experimental studies
7.	Anecdotal evidence (opinion from authority)
8.	Individual case study

The hierarchy of evidence. (Healey and Lyons, 2002;AHCPR, U.S. Dept. Of Health and Human Services, 1992)

It becomes obvious that clinical studies (marked in green) rank highest in this hierarchy.

Providing evidence

For every single product and procedure offered by 3M Oral Care, clinical studies are conducted to prove their safety, efficacy and robustness. This requires large monetary investments in clinical research and an experienced team of experts. At 3M, this team is made up of skilled employees with a background in clinical dentistry and material science. Working in St. Paul and Monrovia in the United States and in Seefeld, Germany, they are responsible for planning and monitoring of all clinical trials initiated by 3M Oral Care. The studies are carried out either in the company's own well-equipped dental operatories or at collaborating universities and dental schools.

Practicing at the 3M Dental Operatory in Seefeld, Germany.

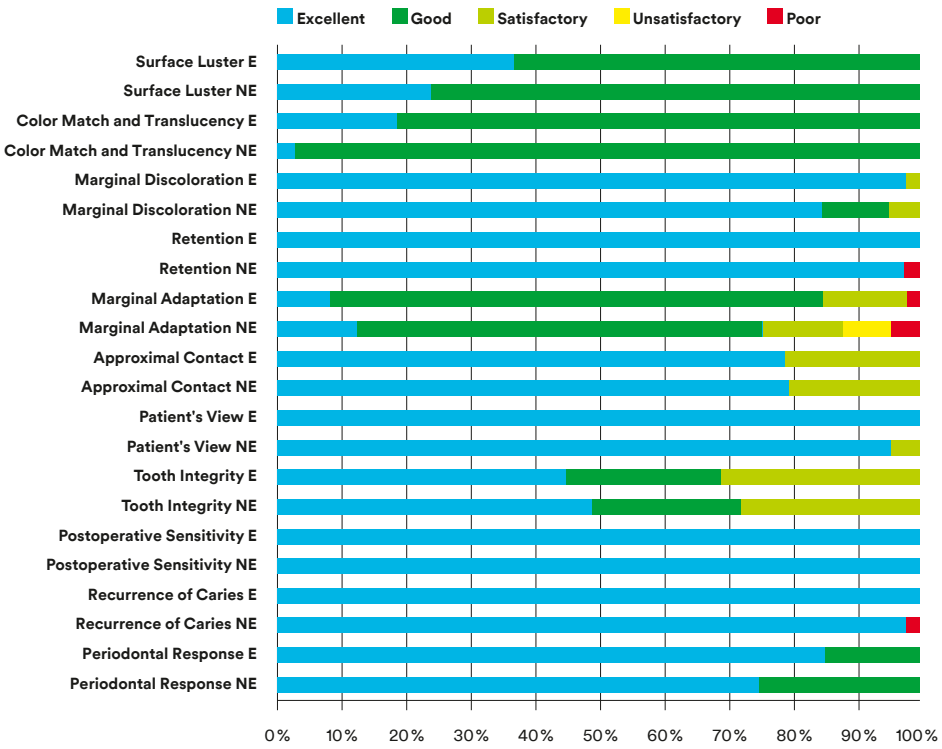
Clinical photograph taken at the 3M operatory for documentation: 3M™ ESPE™ Lava™ Zirconia Maryland bridges after six years in function.

One of the most important preconditions is that studies are conducted at the highest quality, legal and ethical standards following Good Clinical Practice (GCP), ISO 14155, the Declaration of Helsinki and other applicable laws and regulations. An example for relevant clinical trials is provided in the following.

Example studies

Three years ago, two clinical studies on 3M™ ESPE™ Scotchbond™ Universal Adhesive and 3M™ ESPE™ RelyX™ Ultimate Adhesive Resin Cement were initiated at the University of Leuven (Belgium) and the University of Regensburg (Germany). The objective of both studies was to investigate the clinical performance of the adhesive in the self-etch versus selective enamel etch mode and RelyX Ultimate when applied to inlays/onlays produced in a computer-aided chairside procedure.

The main difference between the two studies is that in Leuven, three experienced clinicians were responsible for the tooth preparations and inlay bonding. In Regensburg, student operators carried out the treatment. Both studies have the same primary endpoint comparing marginal restoration integrity upon selective enamel etch versus self-etch. However, the Leuven study evaluates adhesive/cement performance under highly controlled, ideal conditions, while the Regensburg study reflects the robustness of the materials and the procedure. Thus, the Leuven study tests the efficacy, and the Regensburg study the effectiveness of an inlay/onlay cementation procedure with the two products. Both factors are important to evaluate the clinical performance of materials and procedures. Obviously, a comparison of the outcome of both studies and of the two groups (self-etch versus selective enamel etch) within one study would be interesting. In Leuven, the two-year results with 80 multi-surface VITA-BLOCS® Mark II (VITA Zahnfabrik) inlays, onlays or partial crowns are as follows:



Two-year results using FDI evaluation criteria. Loss of marginal adaptation was mainly attributed to marginal ceramic fracture and occurred in areas where the feldspathic ceramic had a marginal thickness of less than 1 mm (E = selective enamel etch, NE = non-etch).

From these data, it has been concluded that no significant difference occurred between the Etching (E) and the Non-Etching (NE) groups except for colour match (McNemar p=0.04). This demonstrates that Scotchbond Universal works reliably even in the self-etch mode. Observed failures were mainly attributable to ceramic fractures, which may be due to the relatively low flexural strength of the feldspathic ceramic. The findings underlined the high performance, versatility, and convenience when using the investigated cementation system.

Glass-ceramic MOD inlay at baseline (left) and after two years in service. Images courtesy of KU Leuven.

Comparable to Leuven, the principal investigator in Regensburg concluded in the interim report that “the simplified, multi-mode adhesive system (Scotchbond Universal) in combination with the respective luting material (RelyX Ultimate) showed similar results with respect to clinical performance and failure rate of partial ceramic crowns, irrespective of the bonding procedure used”. The evidence from both studies is sufficient to conclude that Scotchbond Universal and RelyX Ultimate work efficaciously and effectively for bonding of glass ceramic inlays/onlays to teeth in vivo.

Another randomized controlled clinical trial (RCT) conducted at the University of Michigan, USA, revealed that after two years, onlays made of 3M™ ESPE™ Lava™ Ultimate CAD/CAM Restorative and IPS Empress® CAD (Ivoclar Vivadent) showed excellent margins. For cementation, RelyX Ultimate and Variolink® II (Ivoclar Vivadent) were used. To verify the commonly accepted hypothesis that cement wear stabilizes after two to three years, the study was extended to five years.

Informing users

3M encourages universities to register clinical studies at clinical trial registry platforms such as www.clinicaltrials.gov and always supports publication following the CONSORT guidelines (Consolidated Standards of Reporting Trials).

Usually, the universities’ study results are published in peer-reviewed journals and presented by the researchers at scientific congresses (e.g. IADR). These sources of information are primarily targeted at scientists and not used by general practitioners. To ensure that clinicians are also provided with relevant information, 3M Clinical Research creates short, easy-to-read two-page clinical reports with a summary of the most important study results. These reports provide information about 1. Investigators; 2. Aim of Study; 3. Study Design at a Glance; 4. Results; 5. Conclusions; 6. Related Clinical Investigations and will be available on the product websites as well as via 3M sales representatives.

Conclusion

By producing relevant information regarding the clinical use of products and procedures, 3M Oral Care makes an important contribution to evidence-based dentistry. Users benefit from the availability of the study results and the proven reliability of the products they use.

Listening to the voice of the child: Comfortable and effective treatment concepts in paediatric dentistry

Barbara Cerny, Sigrid Hader and Christiane Stein, 3M Oral Care, Seefeld, Germany

During the 25th Congress of the International Association of Paediatric Dentistry (IAPD) in Glasgow, Scotland, 3M organized a symposium titled "Prevent – treat – cover – maintain". The most important facts presented during this session are summarized in the following interview with the two chairmen (Prof. Dr. Richard Welbury and Prof. Dr. Norbert Krämer) and the speakers Prof. Dr. Jack Toumba and Prof. Dr. Nicola Innes.

Chairmen, speakers and organizers of the 3M ESPE sponsored symposium: Dr. Barbara Cerny, Christiane Stein, Prof. Dr. Nicola Innes, Prof. Dr. Richard Welbury, Prof. Dr. Jack Toumba, Dr. Sigrid Hader and Prof. Dr. Norbert Krämer.

Participants of the symposium.

Professor Welbury, the scientific theme of the 25th Congress of the IAPD was "The Voice of the Child". What is the idea behind it?

The theme of the congress has its origin in the United Nations Convention of the Rights of the Child, Children's and Young People's Charter. It states that all children are entitled to the same rights, including the right to respect, the right to be treated as an individual and the right to be protected from abuse, neglect or exploitation. We believe that this year's Congress is the first to consider oral care for children as part of a much larger and very important picture.

Are the topics of the 3M-sponsored symposium relevant in this context?

Prevention and restorative treatment are highly important elements of paediatric dentistry which have a lasting effect on the development of the permanent dentition. Therefore, the treatments should be made available to all children, irrespective of their social and financial circumstances – an issue that was addressed during the symposium.

Professor Toumba, your lecture focused on the prevention of dental caries and the maintenance of good oral health in children. Why is there still a need to address this topic while the prevalence of caries in kids is steadily decreasing?

With a decreasing prevalence, early childhood caries has become a polarised disease. The implemented programmes and measures work very well in most kids. However, there are some high-risk groups like children from medical, physical, social or ethnic minority groups with a low socio-economic status. These groups will always exist and require intensive preventive measures.

Prof. Dr. Jack Toumba during his lecture.

Please summarize the most important measures for caries prevention and maintenance of oral health in children.

Regular check-up appointments at the dentist's office provide the general basis for caries prevention. The first visit to the dentist should be scheduled after the eruption of the first tooth. The time intervals for subsequent appointments – and for dental radiographs – depend on the assessed caries risk. Effective preventive measures include dietary advice, motivation of the patient and the invoking of parental responsibility to reinforce oral hygiene and toothbrushing measures. In addition, the regular application of fluoride in the office and at home turned out to be effective.

What is the exact level of fluoride recommended and which fluoride delivery method leads to the best results?

This is strongly dependent on the age of the child and the caries risk: Studies have revealed that 0.06 mg/L F in saliva is the clinically relevant level for caries protection. Adult concentrations of fluoride in toothpaste of 1,000 to 1,450 ppm F are best for most of the population, child concentrations are lower. However, for high-risk groups, rinses, varnishes and gels are also needed. Here, it is particularly important to motivate the patients and parents to keep the regular check-up appointments etc. In this group, newly developed slow-release fluoride devices and oral calcium phosphate products may be useful.

Professor Innes, when preventive dentistry fails for children, caries lesions need to be managed, often with a restoration. Please summarize the most important trends in this field of paediatric dentistry.

Prof. Dr. Nicola Innes lecturing in Glasgow.

Alongside the evidence that children can find invasive dental treatment difficult to cope with, we have a picture of changing concepts for caries management. With both fillings and crowns as restorative options, the approaches are moving away from traditional 'complete' caries removal and towards less invasive, more conservative options. One example is the Hall Technique: Instead of local anaesthetic administration, excavation of existing caries and removal of tooth structure, carious primary molars are managed with metal crowns but in a non-invasive way. The decay is simply sealed under the crown. In this way, a sealed environment prevents nutrients being accessible to the bacterial, stopping development of the cariogenic biofilm and progression of caries.

Is the Hall Technique as effective as conventional restorative techniques from a scientific perspective?

There are various study results available which indicate that the Hall Technique is effective in managing caries in primary molars and very well-accepted by dentists, children and their parents. The highest quality studies with the least bias that focus on a direct comparison of crowns versus fillings – two involving conventional crown placement and two using the Hall Technique – tell us that crowns are as good as or outperform fillings, independent of the placement technique.

Are there any guidelines or recommendations that support the dental practitioner in the decision of when to opt for filling therapy and when to choose full coverage crowns?

The decision as to when to place a crown and when to place a filling is a complex one, involving consideration of numerous variables. These include the oral environment and caries or biofilm activity, the cavity type and tooth morphology as well as child factors and social or family issues. Therefore, absolute rules for when to choose which kind of restoration cannot be given, but guidelines can be suggested based on evidence:

First, crowns and fillings will perform well, when carried out using optimal techniques. Second, filling materials are improving, new bulk fill composites may alleviate some of the difficulties with composites. Third, crowns seem to outperform fillings; and fourth, the Hall Technique to fit crowns should be considered since they are less destructive, less demanding of the child and there is growing consistent evidence, across different countries, of their clinical and cost effectiveness. The Hall Technique brochure is available from 3M on request.

Professor Krämer, what are the most important new developments in paediatric dentistry identified during the congress?

Several new approaches were presented during the congress, especially in the field of restorative dentistry. One is the use of zirconia crowns in the primary dentition. They allow for a more aesthetic result than metal crowns, but require a more extensive tooth preparation. On the other hand, there are trends to protect hard and soft tissue: Gentle caries removal or the Hall Technique are minimally or non-invasive and preserve existing structures.

What future trends may be expected and what will be the task of researchers in the field of paediatric dentistry?

Researchers will now have to carry out additional studies that focus on the clinical value of the new developments to broaden the research base. In this way, we will be able to learn which technology or treatment approach will be the best to help children with carious or structurally affected teeth. I really look forward to seeing the results.

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Preventive and restorative treatment approaches for children

Rasha Suliman Elsayed Ahmed, 3M Oral Care, Dubai

The Mohammed Bin Rashid Academic Medical Center in Dubai Healthcare City was the venue of the first Preventive & Restorative Paediatric Dentistry Symposium held in the MEA region in late 2014. The two-day event was attended by 120 paediatric dentists, general practitioners and hygienists interested in the prevention and management of caries in children.

Prof. Dr. Norbert Krämer, Dr. Rasha Ahmed, Dr. Elias Berdouses and Prof. Dr. Jack Toumba.

Caries prevention

In his lecture titled "Prevention of Dental Caries from Birth to Adolescence", Prof. Dr. Jack Toumba (University of Leeds, UK) stressed that it is essential to start with caries prevention very early in childhood. Parents should be made aware of the fact that they have to resume responsibility and supervise their kids in oral hygiene at home. Dentists should give dietary advice and recommendations e.g. regarding the use of fluoride-containing toothpaste or innovative devices for fluoride delivery which is regarded as one of the most effective measures in caries prevention. In addition, plaque assays and the use of fissure sealants are decisive for effective caries prevention in childhood.

Participants during one of the workshops.

Direct restorative techniques

Prof. Dr. Norbert Krämer (University of Giessen, Germany) focused on new restorative strategies in the primary and permanent dentition. According to him, minimally invasive techniques of caries removal are gaining importance also in primary teeth. He recommends resin infiltration for the sealing of enamel carious lesions on smooth surfaces and in proximal areas. When it comes to the minimally invasive removal of dentin lesions without pulp exposure, single-use polymer burs are ideally suited to remove the active caries. There is no requirement to remove all inactive caries, however, sound tissue is needed at the margin for appropriate sealing. In the primary dentition, compomers may be used and a strong bond to dentin is obtained with self-etch adhesives. In permanent teeth, the speaker recommends the use of the total-etch approach for bonding of composite restorations.

Use of preformed metal crowns

In children whose posterior teeth are severely affected by caries, preformed metal crowns like 3M™ ESPE™ Stainless Steel Crowns may be useful. As the speaker Dr. Elias Berdouses (European University College, Dubai) demonstrated, the anatomically shaped crowns are clinically proven and particularly suited in teeth with multi-surface lesions and after endodontic treatment. Every step in the clinical procedure from caries removal and tooth preparation to adaptation and cementation of the crown was described by the lecturer using patient cases.

Gaining practical experience

Following the informative lectures, the participants seized the opportunity to deepen their knowledge in workshops. Here, they focused on the use of rubber dam and strip crowns in kids and were taught specific treatment strategies for the primary dentition of poly-caries patients. They also gained practical experience with preformed metal crowns.

Conclusion

The event which was supported by 3M was a great success: It provided a unique opportunity for paediatric dentists and general dental practitioners alike to update their knowledge regarding the latest findings and recommended techniques in prevention and restorative treatments for children.

Imagina Dental: Time for a change!

Frédéric van Vliet, 3M Oral Care, Seefeld, Germany

“Without change there is no innovation, creativity, or incentive for improvement. Those who initiate change will have a better opportunity to manage the change that is inevitable.”

This is what C. William Pollard states in his book titled The Soul of the Firm. The best-selling author and chairman of a private investment firm is convinced that change should be regarded as a gift.

Change in the dental practice

This is true for the dental office as well: Those who promote and initiate change in their work environment will lay the foundation of a successful future. During the International Congress Imagina Dental in Monaco in spring 2015, it became clear that many of the renowned lecturers have been open to change and integrated intraoral scanners into their dental office.

More than 600 participants attended this year’s Imagina Dental in Monaco.

Versatile tool

According to Prof. Dr. Irena Sailer (University of Geneva, Switzerland), intraoral scanning is a fine example for the fact that digital technology moves dentistry forward: It increases efficiency especially in the dental laboratory. Dr. Cyrill Gaillard (Bordeaux, France) relies on optical impressions to increase the predictability of full-mouth rehabilitations. Dr. Christian Moussally (Paris, France) routinely uses the technology to facilitate minimally invasive procedures in prosthodontics, implantology and orthodontics.

The speakers PD Dr. Jan-Frederik Güth and Dr. Beatriz Gimenez Gonzalez in front of the congress location.

Within the framework of digital smile design, digital impression data of the approved mock-up and the patient’s existing teeth enable Dr. Galip Gürel (Istanbul, Turkey) to communicate with his dental technician in Brazil and provide a reliable basis for his work.

In implantology, several speakers like Dr. Nicolas Boutin and Dr. Bernard Cannas (University of Paris Descartes) carry out prosthetically driven implant planning facilitated by the superimposition of virtual impressions with CBCT scans. As Dr. Ali Tahmaseb (Academic Centre for Dentistry Amsterdam, the Netherlands) pointed out, simultaneous planning of the implant position and the restoration is enabled by the technology. He also stressed that in the future, superimposed intraoral scans of the pre- and post-operative situation may be used as a tool to evaluate the treatment result.

Future potential

Accuracy is an important parameter to assess the future potential of intraoral scanners: Only those delivering highly accurate data will provide a reliable basis for diagnostics (wear analysis etc.), treatment evaluation and the fabrication of complex restorations.

In this context, different in-vitro study results were presented. Dr. Veronika Kostyukova (Moscow, Russia) showed that the technology is generally capable of producing highly accurate data. Focusing on full-arch scanning, PD Dr. Jan-Frederik Güth (University of Munich, Germany) found differences between the devices: The smallest and most constant deviations were achieved with the 3M™ True Definition Scanner. This was also the result of a study conducted by Dr. Beatriz Gimenez Gonzalez (ACTA). The virtual impressions of an edentulous jaw model with six implants taken with the True Definition Scanner were so accurate that an implant bar produced on the basis of the scans would fit precisely.

Conclusion

At Imagina Dental, it became evident that intraoral scanners are already capable of bringing predictability and efficiency into dental procedures. Due to their high accuracy, some of the available devices are optimally prepared for the future.

Quick, easy, true definition!

Alexandra Scherer, Salzburg, Austria

In orthodontics, predictability of the treatment results is of paramount importance. Thus, every step in the procedure has to be carried out with extremely high accuracy. This is why a digital workflow has been developed for the production of customized brackets and archwires within the 3M™ Incognito™ Appliance System.

Several months ago, the integration of the 3M™ True Definition Scanner into this workflow was completed – with additional benefits for the orthodontist and the patient. The digital procedures based on conventional and optical impressions are described in the following case.

Patient case

A 44-year-old female patient presented in my orthodontic office in March 2013 with the desire to correct the crowding of her lower teeth (Fig. 1), without sacrificing the first premolars. We opted for interproximal enamel reduction (interdental stripping) in combination with the 3M Incognito Appliance System. The main reason for selecting this system was that the patient desired an invisible solution. In addition, the system allows me to guide tooth movement and avoid protrusion by pre-setting torque and angulation values.

Figure 1: Initial situation with crowding in the lower jaw.

Preparations

In my office, conventional impressions and a bite registration were taken. Together with the completed Lab Order Form, they were sent to the laboratory: TOP-Service für Lingualtechnik GmbH in Bad Essen, Germany. Since it is difficult to detect inaccuracies in the impressions, a quality check is carried out after production of the models. If inaccuracies are detected, a retake of the impression is required. In the present case, the models passed the controls and were immediately scanned with a high-precision industrial scanner. Based on these virtual malocclusion models, the digital setup was created.

The software used for teeth and occlusal management enables the technician to adjust the arch form, the tooth position, its angulation, torque etc. After completion of the setup process, the occlusion was checked in a virtual articulator included in the software. For additional validation, physical models were produced. Finally, a 3D PDF containing the virtual models of the malocclusion and the set-up were transferred to my office (Figs. 2 to 4).

Figure 2: Screenshot of the 3D PDF showing the superimposed models of the malocclusion and the setup as well as the stripping values for the anterior teeth.

Figure 3: In order to validate the setup, the models can be rotated into all three spatial directions and enlarged on the screen.

Figure 4: Screenshot of the 3D PDF showing the upper and lower setup in occlusion after virtual articulation validated with physical models.

Customized brackets and archwires

Following my approval, computer-aided lingual bracket design was carried out (Fig. 5). This process enables the technician to determine the optimal shape, dimensions and position of the brackets and their bases. As a consequence, the performance of the system is optimized and patient comfort increased. The customized brackets were produced by rapid prototyping using wax and cast in gold. Even the archwires were bent using robotic technology, according to specifications defined in the planning process. In the last step, indirect bonding trays were produced on the malocclusion model.

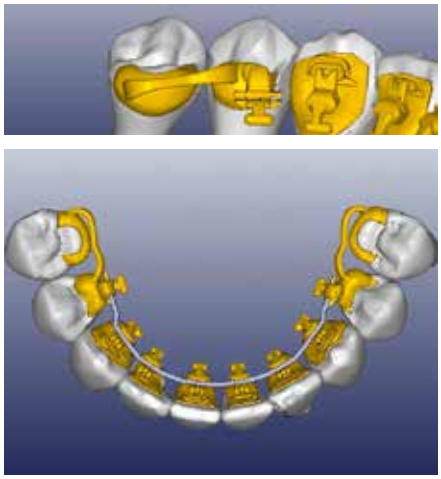

Figure 5: Customized design of the lingual brackets.

The brackets were bonded in the patient's mouth and the first set of archwires was placed. The patient returned for check-up and archwire change after six, nine and twelve months of orthodontic treatment (Fig. 6). The treatment was completed after 15 months (Figs. 7 and 8).

Figure 6: Clinical situation after nine months of orthodontic treatment.

Figure 7: Occlusal view of the treatment result.

Figure 8: Teeth in occlusion.

Intraoral scanning

The new generation of the 3M™ True Definition Scanner was launched in autumn 2014 and was not yet available during the treatment described above. However, we seized the first opportunity to test the device due to the expected savings in time and added precision.

An important precondition for accurate scans is the creation of a dry working field. In this context, the OptraGate® Lip and Cheek Retractor (Ivoclar Vivadent) has proven its worth. After application of a very thin layer of 3M™ High-Resolution Scanning Spray, the scan process is started according to the recommended protocol. Usually, the complete arch is scanned at once, however, the procedure can be interrupted and continued at any time. Finally, the digital impression is checked on the touch screen of the device (Figs. 9 and 10). Errors are thus detected immediately and can be eliminated without the necessity of a complete rescan.

After quality control in the orthodontic office, the acquired data is transferred to the laboratory via the Unitek™ Treatment Management Portal (TMP) for the setup process. In this way, the time for shipping of the impressions is saved and several error-prone work steps such as model production are omitted. In our experience, a further benefit is that the lingual tooth morphology is captured more accurately with the 3M True Definition Scanner than with impression material. Therefore, the bracket bases fit more precisely.

Figure 9: 3D model of the lower jaw. The model is rotated and enlarged to assess its quality.

Figure 10: 3D model of the maxilla and mandible in occlusion. The scans of both jaws are aligned using a buccal scan as a bite registration.

Today, we use the scanner on a regular basis for impression taking prior to an orthodontic treatment with Incognito as well as aligner therapy and during the check-ups for treatment evaluation (Fig. 11).

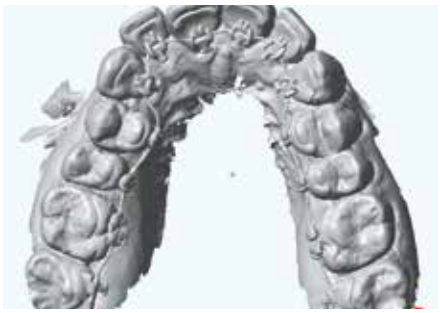

Figure 11: Digital impression taken during check-up for treatment evaluation.

Conclusion

The integration of the 3M True Definition Scanner into the Incognito System workflow was very easy. Thanks to validated interfaces, there is no need for alignment of the components and the data produced with the scanner can be transferred to the laboratory at the touch of a button.

Increased efficiency, higher patient satisfaction and a more precise fit of the bracket bases confirm that it was the right decision to invest in our own scanner.

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Clinical benefits of a new generation of intraoral scanners

Frédéric van Vliet, 3M Oral Care, Seefeld, Germany

As a dental practitioner with a joint office in Berlin, Dr. Helmut Kesler developed an interest in the use of digital dental technologies very early. Being convinced that the computer-aided production of indirect restorations delivers more accurate and higher quality results than traditional processes, he became the initiator and shareholder of a milling centre opened in 2007. Two years later, he was one of the first dentists in Europe to integrate a 3M™ ESPE™ Lava™ Chairside Oral Scanner C.O.S. in his practice. In the years to come, he tested various intraoral scanners and finally decided to purchase a new device – the 3M™ True Definition Scanner – in October 2014.

We had a conversation with this experienced user about the potential of the technology and its evolution.

Dr. Kesler, when you started working with an intraoral scanner in your dental office, most of your colleagues were still sceptical about this new development. What was your motivation for this early investment?

The idea of intraoral scanning was not new in 2009, and we already knew from chairside workflows that the technology works well for the production of single tooth restorations. And since digital technologies had already proven their worth in the dental laboratory by delivering high-quality results, it was just a logical consequence to transform the error-prone step of impression taking into a computer-aided process as well.

You started using the Lava C.O.S. in your dental office six years ago. How did the technology evolve over time?

In the beginning, the range of indications was limited to quadrant impressions for the production of crowns and three-unit bridges. Step by step, the software was optimized and additional indications were released. At the same time, we became more experienced users and tested some experimental indications. In the end, Lava C.O.S. impressions were used in our office as a basis for the production of various kinds of restorations, including long-span and telescopic bridges. And as expected, the device contributed to a noticeable improvement in the accuracy of fit and the quality of the resulting restorations.

Impression taking with the 3M™ ESPE™ Lava™ Chairside Oral Scanner C.O.S.

You seem to be very satisfied with the scanning results obtained with the Lava C.O.S. Why did you feel the need for a new scanner in 2014?

The Lava C.O.S. was one of the first intraoral scanners available for the laboratory workflow. Since its introduction, technology development has driven forward, leading to new standards in software and hardware as well as web infrastructure and data protection. As users of the Lava C.O.S., we were able to benefit from many improvements made available to us via updates, but there were limitations: It is impossible to incorporate every new development into an existing device. Therefore, a new device – the 3M True Definition Scanner – was developed by 3M ESPE. I decided to test it immediately and realized it had numerous benefits from a technological perspective compared to its predecessor. Thus, I was sure that this investment would pay off like the first one.

Digital impression taking with the innovative device.

Please describe the clinically relevant benefits offered by the 3M True Definition Scanner in comparison with the Lava C.O.S.

The 3M True Definition Scanner has a smaller and more robust handpiece which allows for increased patient and operator comfort during scanning. Due to the narrow tip of the wand, easy access to the posterior region is ensured. In combination with an improved software, the slim design allows for a much higher scanning speed that is relevant in the clinical environment. Another feature that improves the user experience is the graphic user interface with its clear

structure for intuitive navigation. Moreover, the combination of Trusted Connections and an open STL output for flexible use of the captured data is highly beneficial. Last but not least, the scanner is connected to the new 3M™ Connection Center that complies with the latest data protection regulations.

Control of the virtual model on the touchscreen.

Before making the decision to purchase a 3M True Definition Scanner, you tested various other devices. What did you learn?

Testing diverse intraoral scanners offered by manufacturers such as Dentsply Sirona (Wals, Austria), 3Shape (Copenhagen, Denmark) and Carestream Health (Rochester, USA), I realized that the available digital impression systems were very different from each other. On the one hand, those differences concerned the scanning process with an impact on quality of the scans. On the other hand, they influenced the complete digital workflow. In fact, it is the scanning software that determines the way the captured data is processed and made available for further steps in the prosthodontic procedure.

Why did you opt for the 3M True Definition Scanner instead of any other device?

Apart from the small size of the wand, it is the superior accuracy of the intraoral scanner confirmed in in-vitro studies and the precision of the complete workflow that convinced me. I know from my own experience that the functional interaction of the scanner software and the 3M™ Margin Marking Software used for model sectioning and preparation margin detection is perfect. This results in highly accurate data imported into the design software – the most important precondition for the production of precisely fitting restorations. Another factor that influenced my decision is the option of scanning overhead. This technique is used in one third of the cases in our office.

Please summarize your clinical experience with the new intraoral scanner.

The 3M True Definition Scanner with its new wand is permanently in use since December 2014. Apart from the standard indications, we started using the Trusted Connection with the Invisalign® workflow (Align Technology) and the open STL option for implant impressions with scan bodies developed by Core3dcentres®. Establishing the new workflow required some experience, while the Trusted Connection worked with the touch of a button – an advantage that is relevant especially for inexperienced users.

Screenshot of a full-arch digital impression.

How do you estimate the overall potential of digital impression taking?

In my opinion, the technology allows us to gain access to an advanced workflow that minimizes the potential sources of error, simplifies the procedure of impression taking and brings increased efficiency into practice and laboratory workflows. And while the extremely high accuracy of the 3M True Definition Scanner is not clinically relevant for the production of single crowns or small bridges, I am sure that it will pave the way for interesting future indications e.g. in the fields of implantology or diagnostics. And with its favorable price-performance ratio, intraoral scanners are no longer unaffordable for the general practitioner.

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Full-arch reconstruction integrating three different cements

Carlos Eduardo Sabrosa, Rio de Janeiro, Brazil

With the availability of various cements for the permanent placement of indirect restorations, it is essential for the dental practitioner to consciously select the ideal cement for each indication.

Personal approach

In my own dental practice, three different cements are stocked. 3M™ ESPE™ RelyX™ Unicem 2 Self-Adhesive Resin Cement is the luting material of choice when retentive restorations such as crowns and bridges made of zirconia, lithium disilicate or metal are to be placed on natural teeth. The material stands out due to its ease of use and establishes a chemical bond to the tooth structure as well as the restoration without the need of surface treatment.

When it comes to the cementation of crowns or bridges to implant abutments, 3M™ ESPE™ Ketac™ Cem Plus Resin Modified Glass Ionomer Cement is preferred. This product offers a tack light-cure option for easy removal of excess material. This is particularly important with implants, because any cement residue bonding to the abutment subgingivally might cause an inflammation and thus lead to periimplantitis.

When the success of the restoration lies on the adhesive properties of the cement and those restorations need a strong chemical bond – either due to the low stability of the ceramic or due to a non-retentive preparation – they are bonded with 3M™ ESPE™ RelyX™ Ultimate Adhesive Resin Cement and 3M™ ESPE™ Scotchbond™ Universal Adhesive. Even laminate veneers with a thickness of over 0.5 mm are bonded with this material combination, as very little light is transmitted through the restoration so that a dual-cure cement is recommended. Very thin veneers can be luted with 3M™ ESPE™ RelyX™ Veneer Cement. In the following patient case, three different cements were used for different indications in the upper arch.

Case example

Figure 1: Initial situation. The patient presented in our practice primarily due to the loss of an implant in the mandible that had been placed a short time ago in alio loco.

Figure 2: The dental examination revealed that the patient had multiple inadequate restorations in both arches that needed to be replaced. The maxillary restorative treatment is described here.

Figure 3: Radiograph of the initial situation. The treatment plan for the maxilla included the placement of implants with zirconia custom abutments in the regions of the right lateral incisor and second premolar and the fabrication of twelve single crowns and two laminate veneers.

Figure 4: Situation after removal of the old three-unit bridge and crown in the anterior area. It is evident that secondary caries had to be excavated and some teeth needed endodontic treatment.

Figure 5: Occlusal view of the maxilla after successful healing of the implants and removal of the temporaries. Endodontic treatment had been carried out where necessary and the corresponding teeth have received a composite build-up, combined with a fiber post in some cases. Teeth that were not endodontically treated were just built up with a low shrink composite resin.

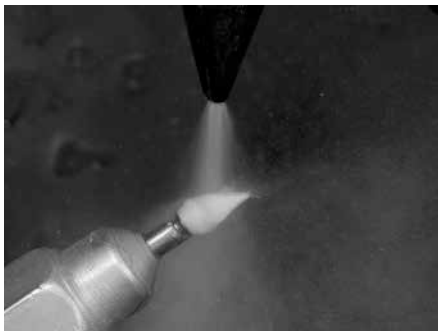

Figure 6: Sandblasting of the abutments made of 3M™ ESPE™ Lava™ Zirconia in order to create a microretentive surface for cementation of the crowns. Etching with hydrofluoric acid is not effective with zirconia due to the low amount of glass in the material.

Figure 7: Occlusal view of the maxillary teeth with the screw-retained abutments in place. All teeth are ready for the final precision impression.

Figure 8: Impression taken with 3M™ ESPE™ Impregum™ Garant™ L DuoSoft™ and 3M™ ESPE™ Impregum™ Penta™ H DuoSoft™ Polyether Impression Material.

Figure 9: Finished restorations on the stone model: Twelve crowns and two laminate veneers made of lithium disilicate (IPS e.max® Press, Ivoclar Vivadent) are shown.

Figure 10: Situation after cleaning of all teeth in the maxilla with an oil-free pumice paste for removal of any temporary cement residues, thorough rinsing with water and drying.

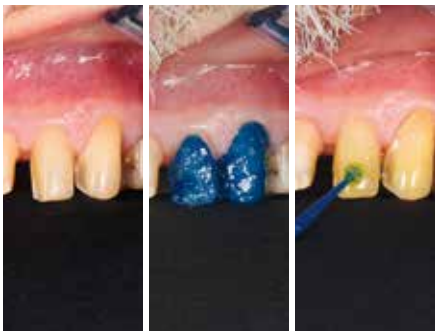

Figure 11: Adhesive pretreatment of the left lateral incisor and canine. After enamel etching with phosphoric acid, 3M™ ESPE™ Scotchbond™ Universal Adhesive is applied, rubbed in for 20 seconds and air-dried until the solvent has evaporated completely.

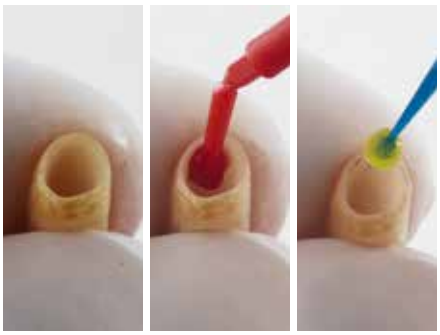

Figure 12: Hydrofluoric acid is applied to the restorations and removed after 20 seconds, followed by cleaning in an ultra-sonic bath for 5 minutes. Then, 3M™ ESPE™ Scotchbond™ Universal Adhesive is applied and used as a ceramic primer.

Figure 13: Application of three different cements from the automix syringe*: For reasons stated above, the self-adhesive resin cement is used for the crowns on natural teeth, the resin-modified glass ionomer cement for the cementation of crowns on implant abutments and the dual-cure adhesive resin cement for the veneers.

Figure 14: Final radiograph.

Figure 15: Treatment result.

Contact

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My sincere thanks to: MW Laboratório de Protése Dental Rosimere Ataliba, CDT

*All cements are also available in the 3M™ ESPE™ Clicker™ Dispenser for handmixing.

Calendar of Events 2016

Date	Event	Location	Website
March 31 – April 2, 2016	2016 ICOI World Congress	Barcelona	International Congress of Oral Implantologists **www.icoibarcelona2016.org**
April 7 – 9, 2016	IMAGINA Dental	Monaco	MONACO MEDIAX **www.imaginadental.org**
April 15 – 17, 2016	SIDEX 2016	Seoul	Seoul Dental Association **www.sidex.or.kr**
April 18 – 21, 2016	DENTAL SALON 2016	Moscow	Dental Expo **www.dental-expo.com**
April 28 – 29, 2016	Scandefa 2016	Copenhagen	Bella Center **www.scandefa.dk**
May 13 – 14, 2016	LMT Lab Day West 2016	Garden Grove, CA	LMT Communications **www.lmtmag.com/shows/71985**
May 20 – 21, 2016	Wiener Internationale Dentalausstellung	Vienna	Österreichischer Dentalverband **www.wid-dental.at**
May 26 – 28, 2016	British Dental Conference and Exhibition 2016	Manchester	British Dental Association **www.bda.org/conference**
June 9 – 12, 2016	Sino-Dental 2016	Bejing	International Health Exchange and Cooperation Centre, Ministry of Health, P.R.China **www.sinodent.com.cn**
June 22 – 25, 2016	IADR General Session & Exhibition	Seoul	International Association for Dental Research **www.iadr.com**
July 14 – 17, 2016	AGD 2016	Boston	Academy of General Dentistry **www.agd.org**
September 7 – 10, 2016	FDI Annual World Dental Congress	Poznań	FDI World Dental Federation **www.fdiworldental.org**
September 17, 2016	LMT LAB DAY East 2016	Atlantic City, NJ	LMT Communications **http://www.lmtmag.com/lmtlabdayeast**
September 20 – 22, 2016	IADR/PER Congress	Jerusalem	International Association for Dental Research **www.iadr.com**
September 26 – 29, 2016	DENTAL-EXPO 2016	Moscow	Dental Expo **www.dental-expo.com**
September 29 – October 1, 2016	EAO Congress 2016	Paris	European Association for Osseointegration **www.eao-congress.com**
October 6 – 8, 2016	dentex	Brussels	ARTEXIS EASYFAIRS **http://www.dentex.be/en**

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