Editorial

Dear Readers,

Recently, the IDS 2005 closed its doors after a very successful week in Cologne: 1550 exhibitors offered their products to more than 75,000 visitors from 141 different countries. Taking place every two years, the IDS is always a unique opportunity to take a look at the future of dentistry, to identify trends and look at new developments. This year, the use of the term “Nanotechnology” in product names was one of the leading trends amongst exhibitors, highlighting the fact there are obviously some different understandings in the dental industry about what is understood by the term Nanotechnology. In this edition of Expertise Magazine you will find more details about the 3M ESPE meaning when using the term “Nanotechnology” in restorative dentistry. During the IDS it was apparent that more and more manufacturers are entering into the field of automatic mixing of impression materials and to be the “gold standard” in impressioning. Also, the future in prosthetic dentistry seems very bright, the live demonstrations of milling and veneering Lava crowns and bridges found a great deal of interest at our exhibition desk. You can read more about both topics in the enclosed Magazine.

Enjoy reading!

Gerhard Kultermann, Editor
3M ESPE, Seefeld, Germany

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The exact reproduction of the intra-oral situation is the most important pre-requisite for a perfect fit of prosthetic work. State of the art precision impression materials are capable to reproduce the intra-oral situation quite well. However, in difficult clinical situations especially if saliva and/or blood is present, many of the commercial impression materials do not show the same performance than they would under ideal conditions. The result might be insufficient precision and detail reproduction especially in critical areas such as the margins.

Polyether impression materials manufactured by 3M ESPE are well known for their very high reliability in all clinical situations. Mainly in moist environment – and there is always moisture present in the oral cavity – polyethers from 3M ESPE convince the dental practitioner as well as the specialist by their compelling results. Therefore, this particular class of impression materials is often referred to as forgiving. 3M ESPE has more than 40 years of experience in polyether development. The exceptionally high reliability of these materials has been proven over several millions of impressions that were taken with great success since their introduction to the marketplace in 1965. The very high degree of accuracy and detail reproduction has set the standard – a fact that is well respected in the dental community.

Continuous innovation has substantially simplified the handling and performance. Automatic mixing in the Pentamix™ System ensures precise dosing of the base and catalyst paste, resulting in a void free impression material and a highly homogeneous mix.

Today 3M ESPE offers polyether impression materials for the one step, two viscosity technique as well as the monophase technique (one step one viscosity technique). The Impregum™ Penta™ Soft Polyether Impression Material product range launched in 2000 was designed to facilitate impression removal, even in difficult clinical settings such as severe undercuts, and provided fresh tasting peppermint flavourings. The Impregum™ Penta™ Soft Quick Polyether Impression Material product range launched in 2004/2005 also answers the need of many dentists for a faster setting polyether with enough intra-oral working time. This is especially useful when dealing with 1 or 2 prepared teeth. The Impregum™ Soft Polyether Impression Material product line is designed to be used successfully in a wide range of clinical applications.

But, what makes the difference between an ordinary impression material and the polyethers manufactured by 3M ESPE? Several requirements have to be met in order to accurately reproduce preparations in the moist environment of the mouth. Key material properties include:

- Pronounced hydrophilicity during intraoral working
- Clinically relevant initial hydrophilicity prior to setting

Development of the 3M ESPE Polyether Product Range
**Product Information**

- Excellent rheological properties
  (see part two of this article in Espertise No. 8)
- Favorable properties throughout the whole working time (snap set)
  (see part two of this article in Espertise No. 8)

Hydrophilicity is needed to precisely replicate a situation which is covered by moisture. Before the development of elastomeric impression materials, impressions were taken using a water based gypsum slurry. This very hydrophilic material captured dimensions and detail accurately but was hard to remove from the mouth once set. It was necessary to cut the cast carefully in the patient's mouth and put the pieces together following removal. Nowadays most of the materials available are labelled hydrophilic. But when is hydrophilicity really needed? It counts from the very moment when the material flows e.g. while syringing or when seating the tray. At this very moment, a new surface of the impression material is generated which is in contact with the moist oral environment. This is the point in time when hydrophilicity is really needed. It counts from the very moment when the material flows e.g. while syringing or when seating the tray. At this very moment, a new surface of the impression material is generated which is in contact with the moist oral environment. This is the point in time when hydrophilicity is really needed for clinical success. Polyether materials manufactured by 3M ESPE are hydrophilic by nature of their chemical make up. This ensures that from the time the polyether is mixed until when it sets, it is characterized by its tendency to favour moist surfaces, such as a preparation, and achieve precise reproductions. This is also known as intrinsic hydrophilicity.

By contrast, silicone impression materials are intrinsically hydrophobic. Hydrophilicity can be gained by adding surface-active components called surfactants. When these materials have contact with moisture the surfactants “migrate” to the surface. This migration needs time and prevents hydrophilicity from fully developing at the first moment that contact is made with moisture – at the point of time when it really matters.

A frequently used method to determine hydrophilicity is contact angle measurement.\(^1\) The lower the contact angle obtained the higher the hydrophilicity. Latest Results are illustrated in the diagram to the left of this paragraph.\(^4\) It is clear to see that initially at the first contact with water (at the time of 0 seconds) the polyethers manufactured by 3M ESPE show the highest degree of hydrophilicity. This is also shown in other studies.\(^3,5,6,7,8,9\)

The very high hydrophilicity of Polymers from 3M ESPE ensures that when in contact with moisture, high-class impressions can be taken with extraordinary reliability.\(^10,11\)

The initial hydrophilicity of the 3M ESPE Polyethers is one of the properties that enable the dentist to take a very precise impression – the pre-requisite for a satisfying restoration.

Article will be continued in Espertise Magazine Nr. 8.: “Clinical relevant features of 3M ESPE Polyethers, part two: flow behaviour – when it counts”.

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Contact angle as a function of time in unset light body impression materials.

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Detailed references available through your local 3M ESPE Dental Products office.
The 150,000th Pentamix™ Automatic Mixing Unit produces impressive proof of the huge worldwide demand for our innovative all-rounder for mixing impression materials.

Since its successful trial launch on the Swiss market back in 1993, the Pentamix has taken the dental world by storm: it sets standards of impression quality, convenience and hygiene that has made 3M ESPE a familiar name in tens of thousands of dental practices. From Germany to Korea – and soon in India and China – the versatile automatic mixing system has established an impressive market presence in countless countries.

What was once a cautious question in the early years, “Is the Pentamix ushering in a new era in precision impression taking?” has long since been answered with a most definite “Yes”. But that’s not all. In combination with the growing range of automatically mixable Penta™ Impression Materials, the Pentamix quickly became the versatile system for all areas of impression taking.

In advertising campaigns it was soon portrayed as a VIP (very important product), rather like a movie star for whom the red carpet is rolled out – and with good reason. Enlargement of the Penta product range triggered almost overwhelming demand, so that in the spring of 1996 production was virtually tripled in the space of just a few weeks. In 1999 things speeded up once again: the significantly faster Pentamix™ 2 Automatic Mixing Unit impressed users immediately by almost halving the time required to fill an impression tray. For many dental practices the Pentamix name was the most powerful reason for making a purchase, and they duly acquired the more powerful successor model as a back-up to their first Pentamix.

As from September 2000, user-friendliness was further enhanced with the PentaMatic™ Foil Bags, which are opened automatically inside the mixing unit. Almost every six months more automatically mixable Penta products become available – after all, dentists have different preferences regarding impression techniques and materials. The emphasis on listening to customer requirements led to another series of innovations, and today, new system components make the Pentamix 2 more efficient than ever. It is thus able to handle materials with a putty consistency, which it had not previously been possible to mix in an automatic unit. A current international survey shows that 84 percent of Pentamix users are either “totally satisfied” or “very satisfied” with their mixing unit. 61 percent stated that if they had to replace their existing unit they would most certainly choose a Pentamix again, while another 29 percent said they would probably do so. These survey results are very positive, but not really surprising, because to date there is not a single competitor who offers a comparable service to the large and important market for dental impressions.

“The Pentamix hardware and Penta consumables complement each other symbiotically to create a highly innovative and versatile solution,” says Eva Geywitz, Global Brand Manager. “We shall continue to build on this competitive lead because it provides a strong foundation for our other innovations in the field of prosthetic dentistry.”
Impressive evaluation results from the field
Elke Kopp, 3M ESPE, Seefeld, Germany

Impressive evaluation results from the field

The first putty from 3M ESPE to be specially developed for automatic mixing in the Pentamix™ 2 Automatic Mixing Unit has been very well received in the field. The excellent results of a large-scale user survey of more than 220 dentists in ten European countries have shown that Express Penta Putty Vinyl Polysiloxane Impression Material from 3M ESPE and the precision wash Express Ultra-Light Body Vinyl Polysiloxane Impression Material meet users’ needs consummately.

Automatic mixing at the push of a button: Express Penta Putty – Vinyl Polysiloxane Impression Material

With the new Express Vinyl Polysiloxane Impression Materials, dentists who prefer a real putty can now also benefit from the advantages of automatic mixing. At the push of a button the homogeneous and void-free mix of Express Penta Putty flows out of the Pentamix 2 Mixing Unit directly into the impression tray. Once in the tray, it is ductile under the fingers, just like a classic putty. Express Penta Putty Vinyl Polysiloxane Impression Material and the wash Express Ultra-Light Body Vinyl Polysiloxane Impression Material are suitable for all precision impressions for crowns and bridges as well as inlays and onlays using the two-step putty wash technique or the one-step tray wash technique.

High level of convenience and hygiene in addition to classic putty properties

As part of a European user survey, more than 220 dentists took more than 3000 precision impressions. The excellent results of their comprehensive assessment of material and working characteristics speak for themselves. 94% of those who took part in the survey found automatic dispensing and mixing with the Pentamix 2 Mixing Unit simple or very simple. Equally as convincing was the verdict on the hygiene aspect of automatic mixing of the putty material: 96% assessed the level of hygiene as better or much better than with their current hand-mixing. Not only that, around half of the dentists estimated the material saving as a result of automatic mixing at medium to high. 90% of users thought that the material could be formed well to very well in the tray using a finger. Just as many rated the consistency of Express Penta Putty Vinyl Polysiloxane Impression Material as very good or good. The carve was said by over 80% to be very easy or easy.

Exact detail reproduction and high tear strength set the precision wash material apart

The precision wash material Express Ultra-Light Body Vinyl Polysiloxane Impression Material also got top marks in the field: 82% of the participants said detail reproduction was excellent or good. Three out of four dentists gave the same assessment of the flow properties and the tear strength.

Dental technicians confirm the outstanding impression quality of both materials

The dentists’ good assessment of the impression precision was confirmed in the laboratory: 84% of dental technicians said the impression quality was good to excellent. The accuracy of fit of the fabricated restorations was rated by 84% of the dentists surveyed as excellent or good. Nine out of ten of those who took part in the survey found the working and setting times of both materials to be optimum for application.

Worth personally recommending, say 79% of the dentists

Besides the great advantages that automatic mixing has, the material properties alone of both viscosities are evidently reason enough to change over: 60% of the dentists said Express Penta Putty Vinyl Polysiloxane Impression Material was better than their current material for the impression tray. Well over half of all dentists surveyed in Europe found Express Ultra-Light Body Vinyl Polysiloxane Impression Material superior to their current precision wash material. So it was no surprise to find out that an impressive 79% of all participants would even personally recommend both new Express viscosities to their colleagues.
Nanotechnology – more than tiny particles

Sumita Mitra, 3M ESPE, St. Paul, USA

It seems that the word nanotechnology has become a rather popular word of marketers of all branches. But what is nanotechnology? The US National Nanotechnology Initiative defines three criteria:

- at least one of the dimensions of the building block must be in the range of 1 to 100 nanometers
- it must create and use structures and devices and systems that have novel properties and functions because of their small size
- the ability to control and manipulate materials on an atomic and molecular scale.

Thus the term nanotechnology should imply a high level of control and planning. Heretofore resin and filler technology had limited our ability to deliver a composite with both excellent esthetics and high mechanical strength suitable for universal application. Could nanotechnology be the technical platform to create a new composite with the following properties?

- good handling properties, e.g. easy to adapt to preparation and non-sticky
- microfill-like polish characteristics - both initially and long-term,
- excellent strength and wear resistance like a hybrid
- a wide range of shades and opacities suitable for a single-shade or a multi-shade technique.

Microfills – Are they nanofills?….. No!

The overuse of the term nanotechnology has led to much confusion. So, it is useful to take a closer look at the conventional dental filling materials and examine the difference between these and true nanocomposites. Microfills are well-known for their excellent esthetics but the fumed silica fillers used to make these materials cause some inherent mechanical problems. The pyrogenic process used to make fumed silica produce strings of silica particles which are aggregated into fibrous, low-density chain like structures. Even though an individual particle can be as small 40nm most of these particles never exist as discrete entities. The fibrous structures of microfills limit the loading of fillers in the resin. The viscosity increases rapidly when fumed silica is incorporated into a resin yielding a rather tacky paste as the filler content is increased. In contrast truly nanomeric fillers can be loaded to a high concentration in a resin and still yield materials with practical viscosity.

To overcome the viscosity problem commercial microfills generally pre-polymerize the tacky mixture of fumed silica and resin to create a pre-polymerized organic filler. This is then added to more resin and fumed silica to create the paste. In consequence microfills have low filler content and poor binding between the prepolymerized filler and resin matrix resulting in inferior mechanical strength so that they cannot be recommended for stress-bearing areas. A comparative flexural strength study1 shows the flexural strength of microfills to be inferior while that of Filtek Supreme is comparable to hybrids and microhybrids. Similar results for diametral tensile strength were reported by Lopez et al.1 These properties make microfills unacceptable for universal composites in spite of their excellent optical characteristics.

Designed Nanomers

In order to fulfil our original objective at 3M ESPE we have developed novel types of nanofillers and used these to design Filtek Supreme. The first of these are discrete nanomeric particles which are either 20nm or 75nm in size. Nanoparticle of a sol are treated with a polymerizable silane and dried in a proprietary process to provide discrete nanomers without any agglomeration. The interfacial stabilization process allowed us to overcome the entropic factor normally responsible for particle agglomeration.

Concept of Nanoclusters: quite different from hybrid fillers

The other type of nanofiller we designed is called nanocluster. These fillers are prepared by lightly sintering nanomers to form clusters, which are then subdivided into nanoclusters of controlled particle size distribution. The nanoclusters are subsequently treated with polymerizable silanes so as to provide good binding with the matrix resin and thus provide optimal mechanical strength and toughness. Unlike dense hybrid filler particles these nanoclusters are porous and allow the resin matrix of the composite to fill the spaces within and between the clusters.

The “grape effect”

Figure 1

Nanocluster

Nanomer

The TEM (Fig. 1) of a section of Filtek™ Supreme clearly shows the presence of the nanomers and nanoclusters. It is useful to draw an analogy of nanoclusters to a bunch of grapes. In the absence of an external force the individual particles of a nanocluster stay together just as would a bunch of grapes. As such the nanoclusters behave like large particles with a broad particle size distri-
bution to provide good handling properties in the composite. However, under abrasive forces encountered in the oral environment individual nanoparticles of the cluster break off akin to individual grapes in a bunch. The resultant surface after abrasion still appears smooth and comparable to microfills as evident from the SEMs. In contrast hybrid or microhybrid particles cannot be further subdivided so that upon abrasion these large particles are exposed and plucked off leaving a rough and dull surface. The atomic force micrograph images (AFM) of a representative microhybrid EsthetX and a microfill Filtek A110 before and after 2000 cycles of tooth-brush abrasion is compared with those of Filtek Supreme nanocomposite containing nanoclusters and nanomers (Fig. 2). After brushing the Filtek Supreme sample preserved its smoothness as well as that of the microfill studied while the microhybrid surface became quite rough. Gloss retention studies after extended toothbrushing for 2000 cycles of abrasion also confirmed the above findings (Fig. 3).

Thus, through careful design, deliberate control and manipulation of nanosized particles 3M ESPE has created a material with novel properties: easy handling, excellent optical characteristics and high mechanical properties: Filtek Supreme - a real nanocomposite.

![Polished Blocks vs Brushed 2000 times](image)

At a clinical study conducted at University of Leuven it has been shown that at one year Supreme is showing a wear rate comparable to human enamel. Kunzelmann et al. found that the in vitro wear of the nanofilled composite Filtek Supreme was superior to all other materials that he had in his study. Clinical studies indicate that Filtek Supreme even appears to have self-polish characteristics. The shine is better after a year than after initial placement and it continues to look good after two years.

**Dr. Sumita B. Mitra, PhD, St.Paul, MN, USA**
Present position: Corporate Scientist, 3M ESPE Dental products Division.
Further Information: Dr. Mitra is the creator of many new materials technologies and the developer of several new product segments for the dental market. Examples are resin-modified glass ionomers, nanocomposites and adhesives for the dental and orthodontic market. Recipient of 50 US patents (and OUS equivalents); authored numerous publications (>80) and book chapters in the areas of polymer science and dental materials. Internationally recognized lecturer on these topics and has lectured in 42 countries. Received numerous honors and awards, both inside and outside 3M. Inducted into 3M’s prestigious Carlton Society (1998) and received the 2004 American Chemical Society Regional Industrial Innovation Award for application of Nanotechnology.
For over 50 years now, local anesthetics have been part of the 3M™ ESPE™ product range, and are trusted by dentists in more than 66 countries around the world. A high level of expertise and the use of state-of-the-art technology are essential aspects of the complex manufacturing process, which we would like to present here, taking the example of Ubistesin™.

Large tanks, a labyrinth of pipes and a variety of gauges and dials confront you when you visit the plant where the chemical synthesis is carried out. Here, the chemists not only produce the active ingredient, articaine, but also the basic materials for Impregum™, Express™, Ketac™ Molar and Adper™ Prompt™ L-Pop™. A multi-stage synthesis, lasting around a week and comprising more than twelve individual steps, such as chemical synthesis, extraction and crystallisation, is required to produce articaine, the active ingredient of Ubistesin.

Continuing on from this synthesis, the active ingredient is processed in a separate production unit where the staff work on a three-shift basis exclusively for the production of 3M ESPE local anesthetics. In special clean rooms, some 65 million cartridges of local anaesthetic are manufactured each year for our customers.

The in-house water-treatment plant purifies and distills the water that forms the basis of the injection solution. Complex processes are used to demineralise and sterilise the water, while continuous testing ensures consistently high quality. The raw materials are added according to the specified formulation. In the case of Ubistesin, the active ingredient articaine and the vasoconstrictor adrenaline are dissolved in the water. Chloride concentration, pH and the concentration of the active ingredient are all measured prior to the solution being filtered to remove minute particles (<0.2µm).

In the meantime, the empty glass cartridges are carefully washed and then rinsed with a silicone oil emulsion. The thin film that remains on the inside walls of the body of the cartridge is burned into the glass by means of four heating stages at temperatures of around 300°C for 2 hours. This leaves a siliconised surface which ensures easy, controlled and smooth injection when the cartridge is used by the dentist.

Filling of the cartridges with the solution takes place in the B zone, which is a Class A clean room subject to extremely strict rules of use and can only be entered via three safety air locks. Rather like the production facilities for computer chips, the B zone is continuously monitored for airborne particles. The staff who work in these clean rooms have to wear special shoes, sterile gloves special overalls with a full hood covering their entire face except for the eyes. Before filling begins, the oxygen in the empty cartridges is driven out with nitrogen to prevent tiny air bubbles from becoming trapped in the solution. A machine then fills the cartridges two-thirds full, allowing the solution to settle before being topped up and immediately sealed with an aluminium cap.

With the filling process complete, the next step is for the Ubistesin cartridges to be sterilised at 121°C and then subjected to internal and external analytical and sterility tests. These tests involve chemists and microbiologists checking the local anaesthetic solution principally for the identity and concentration of the active ingredient and vasoconstrictor, and also the pH value. In addition, they test the stopper for smooth movement. To ensure that the solution is free of all microorganisms, samples taken from every batch are sent to external laboratories, where they are incubated and tested for 14 days.

Only when the solution has passed all these tests does each individual cartridge undergo optoelectronic testing, in which the cartridges are rotated and then abruptly stopped, allowing highly sensitive optical sensors to detect the tiniest particles, such as minute glass splinters, which are invisible to the human eye. These are identified due to their different degrees of inertia.

Only 100 percent perfect cartridges are allowed through to the conveyor belts for labelling. The transparent labels provide the dentist with the product name, expiry date and batch number, which guarantees complete traceability of the product right back to manufacture of the raw materials. The label also serves another important purpose: the special safety foil, similar to the laminated safety glass used for car windscreens, protects the cartridge against splintering. This is particularly important for intraligamentary anaesthesia because of the high injection pressure required.
Each of these labelled cartridges must now pass an electronic sensor, which checks the printed information. Then specially trained staff pack the Ubistesin cartridges in metal cans (50 cartridges per can) with foam padding for protection against damage during transport. In the next production step, a machine seals the cans, and prints the batch number and expiry date on the base. Another electronic sensor checks all the information once again, and only then does the can receive the green light to continue its journey along the conveyor belt, where instructions for use and a plastic lid are added.

At the next station, a label indicating the name and composition of the anaesthetic and important storage instructions is attached.

Finally, our staff checks the tins once again to ensure that they are complete and free of visual damage, before packing them in boxes of 10. From here, the 3M ESPE local anesthetics are dispatched to our customers around the world.

This combination of decades of experience, state-of-the-art production facilities, qualified staff, great attention to detail and continuous inspection throughout the entire production process – from chemical synthesis through to the finished product – is the reason why dentists all over the world trust 3M ESPE local anesthetics.
Aesthetic reconstruction of the anterior maxillary region
Martin Groten, Germany

Aesthetic rehabilitation of the anterior teeth is generally a very demanding treatment which needs a lot of experience. The learning objective of this article is to present several practical clinical observations that will assist the practitioner in attaining predictable aesthetic results with full ceramic restorations.

Figure 1:
Using a situation model mounted on an articulator, the extent of reconstruction and the associated space requirement was determined in a wax-up. From this it was apparent that minimally invasive preparations were indicated for veneers (3) and veneer crowns (1 and 2) with minimal preparation depth in the labio-incisal third of the teeth, incorporating existing composite restorations.

Figure 2:
The preparation margins were defined and finished circularly with a slight chamfer (approx. 0.5 mm) using a fine-grit round head diamond bur. Tooth 21 has a somewhat darker colour due to a root canal filling.

The preparations are largely limited to the enamel. 22 has been prepared mesio-labially down to the dentine for reconstructive positional correction.

Figure 3:
Under the influence of moisture control, a so-called pulpal haematoma (diffuse red region) has formed in this area. The marginal periodontium has been drawn back from the preparation margins using retraction cords (Ultrapak, Ultradent, South Jordan, USA) with a styptic (Racestypine, Septodent, Saint-Maur-des-Fossées Cedex, France). At the same time, the cords absorb sulcal fluid, and therefore assist moisture control during impression-taking. The situation shows the thin cords (size 0), which were laid first. In the two-cord technique employed here, these thin cords remain in place in the sulcus while the impression is being taken.
Second retraction cords (Ultrapak, size 1, with Racestyp) were left in the sulcus for at least 5 minutes before the preparation impression was taken. Only after they had been removed from the sulcus did mixing of the impression material commence. With this procedure, the sulcus remains open (retracted) for several minutes. The impression was taken with Impregum™ Penta™ DuoSoft™ H & L (3M ESPE, Seefeld, Germany) in a stock tray (Rimlock type) using the one-step tray wash technique. The light-bodied phase (DuoSoft™ L) was applied around the prepared teeth from the Garant cartridge and then applied over the occlusal surfaces of the posterior teeth.

**Figure 4:**
Result of the preparation impression taken with Impregum DuoSoft from 13 to 23. The preparation surfaces are reproduced free of voids, and the circularly fully formed sulcus tags clearly define the preparation margins.

**Figure 5:**
Quality of the master model following removal from the impression in the area of the preparations.

**Figure 6:**
The prepared teeth have been temporarily restored with composite. The temporary restorations were fabricated by the direct technique (chairside) with Protemp™ 3 Garant™ (3M ESPE) and a deep-drawn film, which had been fabricated on the basis of the morphology of the wax-up. They were not highly polished but finished with a rubber disc at the chairside. The slide shows the condition after a wearing period of approx. 2 weeks, following reinsertion subsequent to the first try-in of the veneer crowns. They were originally fabricated in a single piece from 13 to 23 (for better retention), but after 2 weeks a crack appeared between the number 1 teeth. This did not pose a problem for use of the temporary work. They were cemented with a eugenol-free cement (RelyX™ Temp NE, 3M ESPE), this time in two parts (13-11 and 21-23).

**Figure 7**
State of the restoration at the half-year follow-up. All the teeth are vital and free of symptoms; periodontal integration is optimal. The pulpal haematoma at 22 (see Fig. 3) has evidently receded without any clinical consequences.
A 25 year old patient presented herself at the dental practice expressing a wish to improve a class IV restoration on the upper left central incisor (21) (Fig. 1).

On the basis of the patient’s clinical history and diagnosis, we decided on a conservative treatment plan: reconstructing the tooth with a composite.

The material Filtek™ Supreme was chosen on the basis of the physical (wear resistance) and optical properties (optimum polishing and polish retention) offered by the material’s nanotechnology.

Once the restoration had been removed a stainless steel pin could be seen (previously diagnosed by radiography). This pin was one of the factors causing the restoration’s dark colour.

The tooth was prepared with a bevel on the vestibular side and a chamfer on the palatal side. After this, the bonding procedure was started (Fig. 2).

We began by using a 35% acid etchant (Scotchbond™ Etchant) for 30 seconds on the enamel and 15 seconds on the dentine.

Next a Scotchbond™ 1 adhesive was used and the layering process begun.

WE (white enamel) was used to imitate the palatal enamel. This gave the restoration luminosity and made the buccal floor opaque. (Fig. 3).

A2D dentine was used to conceal the fracture line and to contour the mamelons (not sure about this either!). The incisal translucency has a slightly yellow tone so the material YT was chosen. Finally, the enamel was applied, using A2B in the central area and A2E in the incisal area. This enabled us to obtain the translucency needed to maintain carved anatomical and chromatic characteristics (Fig. 4 and 5).

Each increment was light cured for 10 seconds. A final 40 second light cure was performed with the help of an oxalate gel for the purpose of oxygen inhibition.

Polishing was carried out with 3M Sof Lex XT discs, and diamond and aluminium oxide pastes (Fig. 6). Immediate postoperative results showed slight signs of bleaching of the adjacent teeth due to dehydration during the restoration and polishing process. This increased the quality of the restoration.

The results are satisfactory four weeks after the procedure (Fig. 7 and 8).
Digital dental photography enables dentists and technicians to produce pictures more efficiently and thus save valuable time. The number of sessions the patient is required to visit the laboratory or that the technician has to go to the dental surgery, can be reduced. The following article outlines some suggestions regarding the successful use of digital photography. All the photographs in this article were taken with an SLR (single-lens reflex) camera, which permits faster and more flexible working than any compact digital camera, no matter how professional it may look.

Fig. 1 with the anterior teeth in terminal hinge position shows how symmetrical camera alignment ensures an aesthetic image. Furthermore, the selected section of the image focuses on what is essential. A small aperture ("22" or "32") was used to give maximum depth of focus. At the same time, a powerful professional lateral flash was used to illuminate the subject brightly and uniformly.

Fig. 2 demonstrates the need to inform the dental technician about the initial clinical situation - e.g. completely different abutment coloration – by means of a computer file, and to assist him in the choice of promising ceramic materials. The photograph of a quadrant which fills the entire frame (Fig. 3) is the acid test of a good dental photography kit. Here, the horizontal alignment ensures clarity and comparability. Images of master casts not only serve as documentation, but also provide motivation when it comes to consultation in relevant cases (Fig. 4). Just as for taking a portrait picture of a patient, the camera’s flash is switched off, and daylight, room lighting or large-area studio flash lighting is used instead.
As one of the younger generation of dental technicians, Jan-Holger Bellmann, Jever, puts high-tech processing and economy on an equal footing with aesthetics and human creativity. In his view, these are factors which will play an increasingly important part in the dentistry of the future and in the job description of the dental technician. From this perspective, new technologies can be seen as a strong basis on which traditional ideals in dentistry, and the extremely high standards that the art of veneering is expected to fulfil, can be realised even more effectively.

Do we really need all-ceramic?

After all, the porcelain fused to metal technique has been very successful in the day-to-day work of the dental laboratory. If an all-ceramic system is to be a real alternative to the PFM technique, it must be better than, or at least equally as good as metal, as regards the following points.

**Biocompatibility and aesthetics:** With regard to biocompatibility, all-ceramic materials are far superior to precious metal alloys. Similarly, in terms of aesthetics there is, I believe, no discussion about whether more attractive results are achieved with all-ceramic or metal ceramics. There are, however, major differences between the various all-ceramic systems, and particularly the zirconium oxides. (Fig.1).

**Durability:** When it comes to durability, there is almost no alternative to zirconia, at least for the posterior teeth, if you choose the all-ceramic option. But here too, the strength values of zirconias range from 900 Mpa to 1,500 Mpa. At above 1,100 Mpa, Lava is four times stronger than the maximum masticatory load to which posterior teeth are subjected (Fig 2). Due to their high strength, we are already able to use zirconias for bridge spans up to four units without any problem.

**Accuracy of fit:** With respect to accuracy of fit, you have to look rather carefully at the results obtained with CAD/CAM systems, as there are enormous differences. Of the manufacturers of such systems that I know, only two have really managed to convince me up to now: Procera and Lava. In the meantime we work almost exclusively with Lava because the range of indications for this system includes both individual crowns and bridges for the entire anterior and posterior regions. This enables our dentists to offer their patients aesthetically homogeneous restorations with uniform materials. What’s more, for Lava the laboratory does not have to purchase an expensive scanner.

**Handling and cost-efficiency:** At the end of the day every laboratory proprietor is faced with the decision on whether to invest in a new technology like CAD/CAM, and consequently to take on board the task of learning new work processes. At the dental practice of Peter W. Hirschfeld in Jever, we decided to have this work done by a milling centre (P. Hanning, Detmold) and to concentrate ourselves on the subsequent finishing of the frameworks. In this way we have eliminated virtually all investment risk. The veneering ceramic for the Lava System, the Lava Ceram Master Set, is certainly affordable.

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**Fig.1:** Excellent translucency of the coloured zirconium oxide frameworks

**Fig. 2:** Lava anterior bridge in situ. It withstands masticatory forces up to 1,100 Mpa.

**Fig. 3:** Vital appearance of anterior crowns veneered with Lava Ceram
Casting technique on the decline

In my view, CAD/CAM technology and zirconia are going to have a decisive influence on the future of dentistry. It may only be a few years before they replace casting altogether. At our laboratory, for example, we now use hardly any metals at all, which saves us the typical problems associated with the casting technique (stresses, porosity, batches of investment materials etc.).

Veneering

I quickly became familiar with the Lava Ceram range of ceramics. Once you adopt a creative approach, you soon get a feel for the design potential offered by these materials. Furthermore, with the modified enamel porcelains E1 to E4 even a standard build-up produces very pleasing results (Fig. 4 and 5).

All in all, Lava Ceram is a decidedly user-friendly ceramic material: it does not crack and is very resilient. The good selection of transparent and effect materials is sufficient even for complex build-ups. Compared to the PFM technique, or indeed other zirconia systems, oxide, opaquer and liner firings are not required with Lava, which saves a considerable amount of time.

Advantages for the dentist

The coloured zirconia frameworks mean that Lava provides, as it were, a built-in ceramic shoulder made of zirconium. Conventional or temporary cementation presents no problem. For permanent cementation, the self-adhesive universal cement RelyX™ Unicem from 3M Espe is recommended. The inside surfaces of the framework do not require any pre-treatment prior to cementing, nor does the enamel or dentin of the tooth. As you can see here too, Lava performs at least as well as the PFM technique, but surpasses many other all-ceramic systems, such as pressable ceramics, which can only be adhesively bonded.

Conclusion

We now have come to value the Lava System and have treated a large number of patients with Lava crowns and bridges. Of course, any new system takes some getting used to for the dental technician and dentist, but things are looking bright for us thanks to the progress we have made with zirconia and CAD/CAM technology. With Lava it is possible to offer a high-tech product without having to make a major investment.

But if you ask me whether, in future, teeth will only be made by computer; my reply would be that I do not think so. Rather, the high-quality craftsmanship of the dental technician will play a greater role in his day-to-day work than ever before.

Human skill and a feel for colour and shape, aesthetics and artistic ability are central to our work. The future is colourful.

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Fig. 4: Aesthetic result with relatively simple Lava Ceram build-up

Fig. 5: Build-up design using the enamel porcelains. Only the selective combination of the small number of enamel and transparent porcelains creates contrast. Here whitish and yellowish enamel porcelains are deliberately placed next to each other.

Fig. 6: Quadrant restoration with Lava
1022 Dentists Attended Dental Conference in Minsk
Svetlana Mazepa, 3M ESPE, Belarus

Taking place at Minsk Medical University on 19th November 2004, the conference included presentations from Roland Frankenberger (Germany), Andrey Peshko (Ukraine) and Nikolay Polonejchik (Belarus). Covering topics including aesthetic restoration, adhesive systems and impression materials, the conference attracted 1022 dentists from all regions of Belarus.

Roland Frankenberger, Associate Professor at the dental school in Erlangen-Nürnberg (Germany) in his brilliant presentation, combined perfectly both the theoretical background and the practical outcome of modern dental materials and techniques. “Adhesives – State of the Art 2004” and “Direct resin composite restorations – possibilities and challenges” were the titles of his two lectures.

Andrey Peshko, General Dental Practitioner and 3M ESPE Professional Support Representative (Ukraine) performed a lecture titled “Composite restorations with the use of a silicon matrix” attracted the attention of the audience by combining great professional knowledge with a high level of practical skills.

From the side of Minsk Medical University, Professor Nikolay Poloneichik, Dean of the Dental faculty performed a lecture entitled, “Preventing typical mistakes during impression taking”.

More than 1000 conference attendees followed the presentations in the completely filled lecture hall.

Following the event, the local 3M ESPE team received plenty of thanks and positive comments from the participants admitting that the conference is now the main annual event for the whole dental community in Belarus. Dentists mentioned among the reasons of this phenomenon that 3M ESPE always demonstrates the highest level of organization and the real understanding of dentists’ actual needs in gaining the latest information. The open-minded exchange with foreign colleagues during the conference helps to improve the professional level of dentistry in Belarus and speakers invited by 3M ESPE always provide a strong professional input for the daily work of a practitioner.
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