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PI BRÅNEMARK

University of Gothenburg professor and companion Tomas Albrektsson about his recently passed friend and discoverer of the concept of osseointegration.

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A NEW GLOBAL PLAYER

DT recently visited the headquarters and main production facility of MIS, an Israeli specialist in the development and production of advanced dental implantology products and solutions.

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NANO-HYBRID COMPOSITES

Aside from ceramic inlays, patients can now choose direct composites as a functional and aesthetic alternative to metal restorations in the posterior area.

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The World's Dental Newspaper · Nordic Edition

Editorial

Dear reader,

The majestic tranquillity of the landscape, a liberal lifestyle and simple yet timeless design—these are only some of the distinguishing characteristics of countries in the northern part of Europe. What they also have in common is extraordinary dentistry. In 2008, Sweden, Norway and Denmark were the first countries in the world to ban dental amalgam, thereby setting a trend that has gained momentum recently with the signing of the Minamata Convention on Mercury, which aims to eradicate the industrial use of mercury-containing products on a global scale.

It is also here in the north where, among other important inventions, such as the air turbine handpiece, the concept of dental implantology was born with the breakthrough discovery of the possibility of integrating bone tissue with an artificial material like titanium by University of Gothenburg researcher Per-Ingvar Brånemark. Sadly, the field lost one of its most ingenious and probably most modest personalities at the end of last year when he passed away after a period of illness; we mourn him.

His innovative spirit, however, has survived in the form of the many innovative dental businesses based in the region. With a strong focus on digital technologies, these companies will continue to play an important part in the way dentistry will be conducted around the world in the future.

Something Nordic dentistry has been missing is a speciality publication for the approximately 25,000 professionals who conduct their trade between the sandy beaches of Lolland and the icy cold of the Arctic Circle. Addressing this need is the latest edition to Dental Tribune International's portfolio.

Developed as a pan-regional title, the new Nordic edition you are holding in your hands will cover and analyse everything dentistry in the region, as well as internationally. With four editions per year and published in English only, it builds on the substantial knowledge and publishing expertise that has distinguished Dental Tribune partners in almost every corner of the world for the last two decades. We are pleased to welcome you as a member of our already extensive global readership of 600,000 dental professionals and look forward to your opinions and suggestions.

Sincerely,
The Dental Tribune Nordic editorial team

New research on glass ionomer cements

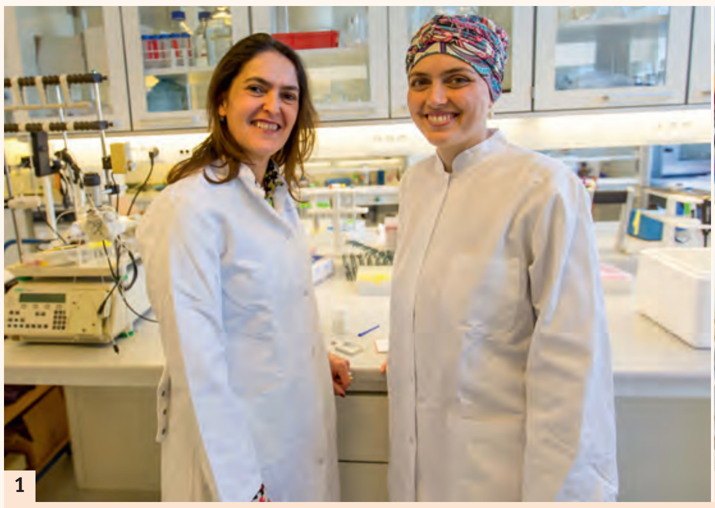


Fig. 1: Dr Heloisa Bordallo, associate professor and materials researcher at the Niels Bohr Institute at the University of Copenhagen and Dr Ana Benetti, dentist and researcher at the Odontological Institute at the University of Copenhagen, collaborated in the development of a strong material for tooth fillings made out of glass ionomer cement. (Photo courtesy of Niels Bohr Institute, Denmark) – Fig. 2: Glass ionomer cement powder can be mixed with a liquid by hand without the use of special equipment and the material does not need to be illuminated with a lamp to harden. (Photo courtesy of Niels Bohr Institute, Denmark) – Fig. 3: X-ray and neutron images show how porous the cement is. On the left are X-rays of teeth with fillings of glass ionomer cement, on the right are images of the same teeth using neutron scattering. Pores and cracks are better visible in the X-ray images due to better resolution (a, c, e). The neutron images suggest that interconnecting pores or cracks are filled with liquid (b, f), while some of the larger pores seem to be empty (d). (Photo courtesy of Benetti, A.R. et al., Scientific Reports).

COPENHAGEN, Denmark: An interdisciplinary team of scientists from the Niels Bohr Institute at the University of Copenhagen is developing a strong and easy-to-use material comprised of glass ionomer cement for tooth fillings. The researchers analysed the effect of different preparation methods on the texture and durability of the material.

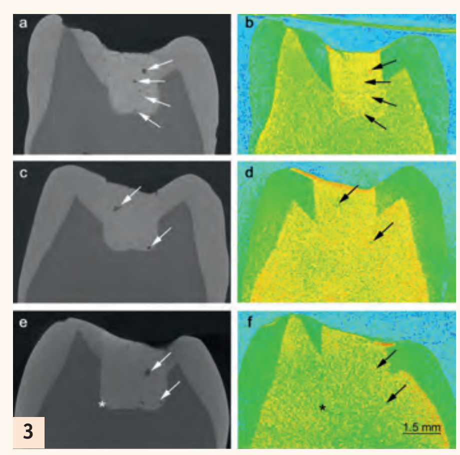
Tooth fillings have to resist high mechanical forces, as well as bacteria and chemicals. Since ancient times, a variety of materials have been used, each with its advantages and drawbacks. According to the scientists, amalgam, for example, is a strong material, but has the disadvantage of containing mercury. Some non-toxic options, such as composite materials based on acrylate, however, have proven to have a lower longevity under the harsh conditions of the mouth in a number of studies and need to be replaced more frequently. In addition, composite materials require an adhesive to bond the filling to the tooth.

In the current study, a glass ionomer cement was used as a restorative material because it is biocompatible and mercury-free, according to the researchers. "Glass ionomer cement has the advantage that it does not need an intermediate layer of adhesive to bond to the tooth and it also has the interesting property in that it releases fluoride, which helps to prevent cavities. The material also has good biological properties, while it is almost as strong. Our research therefore focuses on understanding the connection between the microstructure of the material and its strength in order to improve its properties," explained Dr Ana Benetti, dentist and researcher at the Faculty of Health and Medical Sciences at the university.

When pulverised, glass ionomer cements can be mixed with a liquid by hand without the use of special equipment. Further, the material does not need to be illuminated with a lamp to harden, something that is necessary for composite materials. The latter is an advantage in places with no electricity, such as remote parts of Africa, China or South America.

Two problems with the current glass ionomer cement are that the material is porous and that tiny pockets in the cement can retain fluid, which causes the cement to crumble. The researchers therefore considered the best way to mix the cement to avoid crumbling. They experimented with two different types of pulverised cement. One contained a blend of acid and was later mixed with water. The other was acid-free and blended with water containing an acidic mixture.

In order to determine which preparation process made the fillings most stable, the researchers afterwards performed a series of radiographic and neutron-scattering experiments that were carried out at the Helmholtz Centre for Environmental Research in Berlin. "First, we took X-rays of the teeth with the cement fillings. They show the structure of the material. Glass ionomer cement is porous and you can get an accurate image in 3-D, which shows the microstructure," explained Dr Heloisa Bordallo, associate professor and materials researcher at the Niels Bohr Institute. Next, the scientists captured images of the material using neutron scattering in order to visualise hydrogen atoms, which are found in all liquids.



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By comparing the radiographs with the neutron images, the researchers determined which preparation process resulted in a drier and thus more stable material. "Experiments showed that the combination where the acid is mixed up in the cement, so you only have to add water to the cement powder is the weakest material," explained Bordallo. The strongest material resulted from cement powder mixed with water that had had acid added to it. Thus, it is better to have the acid in the water, since it helps to bind the liquid faster and more strongly to the cement and leaves less water in the pores, according to her.

However, the scientists concluded that at this point of the development process there is still too much loose liquid in the pores of the material. Therefore, the research on glass ionomer cements will continue with new mixtures, including natural minerals added to the cement, in future experiments.

The results of the latest research were published online in the Scientific Reports journal on 10 March in an article titled "How mobile are protons in the structure of dental glass ionomer cements?".

Study finds e-learning as good as traditional training for health professionals

LONDON,UK: Electronic learning could enable millions more students to train as doctors and nurses worldwide, according to the latest research. A review commissioned by the World Health Organization (WHO) and carried out by Imperial College London researchers concluded that e-learning is likely to be as effective as traditional methods for training health professionals. These new findings support the approach to continuing education Dental Tribune International (DTI) has adopted with its free online education platform for dental professionals.

(DTI/Photo Odua Images)

The Imperial team, led by Dr Josip Car, carried out a systematic review of the scientific literature to evaluate the effectiveness of e-learning for undergraduate health professional education. They conducted separate analyses on online learning, which requires an Internet connection, and offline learning, delivered via CD-ROMs or USB flash drives, for example.

The findings, drawn from a total of 108 studies, showed that students acquire knowledge and skills through online and offline e-learning as well as or better than they do through traditional teaching.

E-learning, the use of electronic media and devices in education, is already used by some universities to support traditional campus-based teaching or to enable distance learning. Wider use of e-learning might help to address the need to train more health workers across the globe. According to a recent WHO report, the world is short of 7.2 million health care professionals, and the figure is growing.

The authors suggest that combining e-learning with traditional teaching might be suitable for health care training, as practical skills must also be acquired.

According to Car, from the School of Public Health at Imperial, "E-learning programmes could potentially help address the shortage of healthcare workers by enabling greater access to education; especially in the developing world the need for more health professionals is greatest."

While the study focused on the education of students, DTI follows a similar approach to continuing education, offering webinars via its Dental Tribune Study Club, which it launched in 2009. The platform regularly offers free online courses and in several languages. The wide range of topics includes general dentistry, digital dentistry, practice management, as well as specialties, such as implantology and endodontology. The webinars are presented by experienced speakers and participants are awarded continuing education credits.

Per-Ingvar Brånemark—An innovative genius

Prof. Tomas Albrektsson, Sweden, remembers the man who changed dentistry with the discovery of osseointegration of dental implants

Per-Ingvar Brånemark.

Per-Ingvar Brånemark passed away on 20 December 2014 at the age of 85. Throughout his career as a researcher, he overcame fierce opposition to dental implants and revolutionised methods for treating edentulous patients.

An extremely gifted scientist, Brånemark was also as witty and quick on his feet as they come. Various language editions of Reader's Digest, hardly considered a medical journal of note, published an article in the late 1960s about his research on microcirculation. At the end of his first lecture about dental implants in Landskrona in Sweden in 1969, a member of the audience, who turned out to be a senior academic of Swedish dentistry, rose and commented, "This may prove to be a popular article, but I simply do not trust people who publish themselves in Reader's Digest." As it happened, that senior academic was well known to the Swedish public for having recommended a particular brand of toothpick. Brånemark immediately rose and struck back, saying, "And I don't trust people who advertise themselves on the back of boxes of toothpicks."

Young and naive as I was, I thought they were just poking fun at each other, but it turned out to be the opening shot of an eight-year battle with the dental profession. When someone cast aspersions on dental implants several years later because Brånemark was not a practitioner, he lost no time in replying, "Teaching them anatomy is good enough for me."

Brånemark completed his medical training at Lund University in 1959 with a doctoral thesis on microcirculation in the fibula of rabbits. Grinding the bone to a state of transparency permitted the use of intravital microscopy to analyse the blood flow in both bone and marrow tissue. The thesis, which found wide recognition both in Sweden and abroad, landed Brånemark an appointment at the Department of Anatomy of the University of Gothenburg just a year later. He was appointed as Associate Professor of Anatomy (later received a full professorship) in 1963, which qualified him for laboratories of his own and the opportunity to surround himself with a team of researchers.

Brånemark continued to pursue his studies in microcirculation in animal models and ultimately in humans. A plastic surgery technique was used to prepare soft-tissue cylinders on the inside of the upper arm. He then inserted optical devices encased in titanium that enabled intravital microscopy of microcirculation in male volunteers.

By the late 1960s, he was able to produce the highest resolution images of human circulation in the history of medicine. Many people are familiar with Lennart Nilsson's photographs of circulation that were taken at Brånemark's laboratories and developed at the Department of Anatomy. Brånemark used a hollow optical device surrounded by titanium to study microcirculation in rabbit bone, permitting both bone and blood vessels to grow through a cleft where they could be examined by means of light microscopy. During such an experiment in 1962, he discovered that the optical device had fused into the bone, a process that he eventually dubbed osseointegration. He revealed his incomparable strength as a researcher at that very moment, realising immediately that the discovery had clinical potential and determining to focus on the development of dental implants, an enterprise that had hitherto been regarded as beyond the scope of medical science.

Brånemark grasped the fundamental truth that edentulousness represents a significant disability, particularly for people who cannot tolerate dentures for some reason. He operated on his first patient in 1965, a mere three years later. The academic community was largely distrustful and hostile to the new approach. The debate was not put to rest until 1977, when three professors at Umeå University in Sweden announced that Brånemark's technique was the recommended first-line treatment. Opposition in other countries eventually waned as well and dental implants, originally manufactured by a mechanic in the basement of the Department of Anatomy, scored one international triumph after another.

Nowadays, an estimated 15–20 million osseointegrated dental implants are installed every year, and a number of different academies in the field hold annual conferences attended by as many as 5,000 participants each. The University of Gothenburg features a permanent exhibit on osseointegration technology and there is a museum in Brånemark's honour at the Faculty of Stomatology of Xi'an Jiaotong University in Xi'an in China. The P-I Brånemark Institute has been also established in Bauru in Brazil.

Dental Group Editor Daniel Zimmermann talking to Per-Ingvar Brånemark at a conference in Gothenburg in 2009. (Photos Archive)

Not only dentistry

Back in the 1970s, Brånemark began collaborating with ear specialists and technicians at Chalmers University of Technology to explore the additional potential of osseointegrated implants for developing hearing aids inserted behind the ear. Hundreds of thousands of patients around the world have had operations based on the technology initially developed in Gothenburg under his direction. Those of us who were on the team at the time will never forget a teenage girl who suffered from the effects of thalidomide. The medicine had caused not only limb deformities, but also hearing loss in many patients. Equipped with the new hearing device, she learnt to speak flawlessly.

The team also targeted facial deformities occasioned by congenital or acquired injuries. A number of implants installed in the viscerocranium served as fasteners for silicon prostheses, a much more attractive option than attaching them to the patient's glasses. Since the first operation in 1977, the use of the technology has become widespread internationally.

Titanium implants installed in the femur were the next spin-off of Brånemark's research. Patients with above-knee amputations cannot have socket prostheses around soft tissue and may have to rely on a wheelchair to get around. Inserting titanium screws in the femoral stumps permitted the installation of a prosthesis and the ability to walk again. I can still remember the first patient as if it were yesterday. Another teenage girl had been run over by a streetcar in Gothenburg and had above-knee amputations in both legs. She was consigned to spending the rest of her life in a wheelchair. The operation was highly successful and she learnt to walk again.

Acclaimed around the world

Brånemark was fuelled by a passion to help difficult-to-treat patients, and many of his clinical discoveries from the first dental implant on were made in response to cases that had been regarded as hopeless. His innovative genius, fortified by a large research laboratory at the Department of Anatomy, also skyrocketed Gothenburg-based pharmaceutical companies like Nobel Biocare and Astra Tech into leading positions in the global market. He was devoted to the academic community's social responsibility long before many of his colleagues were aware of, much less accepted, the concept. Ultimately, the world came around and he was awarded honorary doctoral degrees by 29 universities and honorary memberships by more than 50 scientific associations—not to mention the Royal Swedish Academy of Engineering Sciences's medal for technical innovation, the Swedish Society of Medicine's Söderberg Prize, the European Inventor Award for Lifetime Achievement and many other distinctions around the world. DT

Prof. Tomas Albrektsson

is working as a professor at the universities in Gothenburg and Malmö in Sweden. He can be contacted at tomas.albrektsson@biomaterials.gu.se.

"It is our mission to simplify dental implantology"

DT visits the MIS headquarters and main production facility in Israel

MIS Implants Technologies is a global specialist in the development and production of advanced dental implantology products and solutions. The company, which started as a family-run business, was founded in 1995—a time when not many people understood the potential of dental implants, CEO Idan Kleifeld told *Dental Tribune (DT)* at a meeting at the beginning of 2015.

Since its beginnings, MIS has seen significant growth, especially within the past ten years. "Today, the company has succeeded in building a recognised global brand in the market and is the only non-premium company operating on a global scale," Kleifeld said. Headquartered in Israel, MIS currently has operations in 65 countries worldwide, covering major dental markets, such as the US, China and Germany, through a well-established network of local distributors.

In 2009, MIS moved operations to a large purpose-built production complex located in a new high-tech industrial park in northern Israel. "Our location adds to our uniqueness. Israel is a country of high innovation and offers particularly favourable conditions for manufacturing, because of the quality of education and people's high levels of motivation. Furthermore, salaries are much lower than in competitor countries, making manufacturing especially profitable," he stated.

The MIS building in the Bar-Lev Industrial Park spans about 10,000 m² and has two production floors with 50 Swiss high-precision machines running 24 hours a day from Sunday to Friday. "The facility was designed and built for growth. In the near future, our automatic warehouse, which currently covers only half of its potential total area, will double in size," Kleifeld explained.

DTI further learnt that MIS primarily produces for stock, as products must be shipped to local distributors within two working days. For increased efficiency, processes controlling quality, sterilisation, packaging and storage are largely automated. This allows MIS to produce over 800,000 implants per year.

The production site in Israel has a dedicated training centre with a fully equipped dental clinic for live surgeries. Kleifeld said, "We see education as an important tool to acquire new customers, especially in developing markets. It is an important driver in this business, and we offer doctors both fundamental and advanced training courses on MIS products and protocols."

MIS headquarters (Photos courtesy of MIS, Israel)

In 2015, MIS will be introducing some important innovations. Only recently, the company officially opened its MCENTER Europe, the new MIS digital dentistry hub in Berlin in Germany, in order to meet the needs of its growing customer base in central Europe. The centre offers direct services provided by locals to local customers, bringing all MIS digital dentistry products together in one location. It is aimed at providing a comprehensive range of services to clinicians through advanced digital dentistry and CAD/CAM technologies that facilitate fast and accurate surgical implant procedures with reduced chairside time and greater predictability in outcomes.

"We are extremely excited about the opening of the new MCENTER Europe facility, and especially proud to be able to offer MIS quality and simplicity in providing our customers throughout the region with highly accurate and efficient guided implant placement procedures and CAD/CAM solutions," said Christian Hebbecker, MCENTER Europe Manager.

> "We are set to become the largest global dental implant producer."

In addition to the new MCENTER Europe, the company will be entering the premium segment for dental implants with the launch of a new implant system later this year. It has a truly innovative design and consists of high-quality implants that are completely new in the market and will fit within the premium segment. MIS plans to offer this new implant system to its global distributors at the end the second quarter of 2015, for local distribution worldwide.

The name MIS originally stood for "Medical Implant Systems". However, it is also an acronym that reflects the company's main maxim to "Make it Simple". "It is our mission to simplify dental implantology and, in order to become the preferred choice of dentists worldwide, we offer new and innovative products based on simple, creative solutions. Design and handling are made simpler, and all products are engineered to allow efficient, time-saving surgical procedures," Kleifeld said. "With this simplified approach, we are set to become the largest global dental implant producer," he added.

However, the "Make It Simple" motto appears to apply to more than the company's products. The MIS philosophy defines almost all areas of the business (from human resources to production), and the organisational structure is simple and characterised by flat hierarchies. "Make it Simple" embodies the start-up mentality that remains vibrant in a company that has become one of the largest in the global dental implant market.



Production.—Right: MIS Implants Technologies CEO Idan Kleifeld.

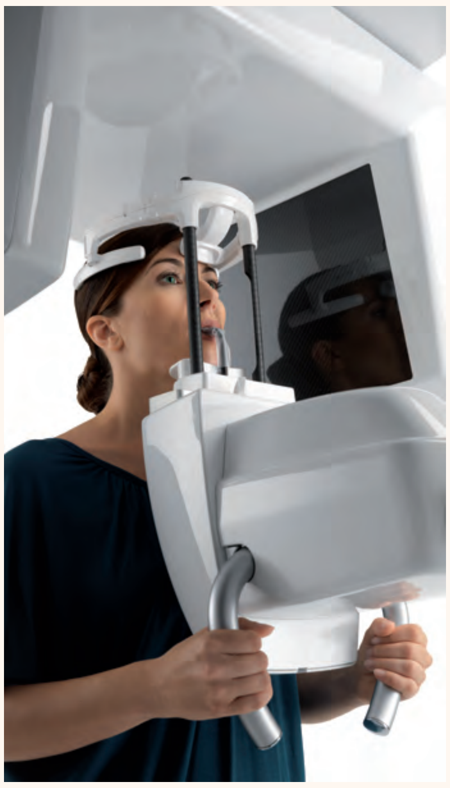
VGi evo from NewTom boosts standard CBTC performance

Innovative system features SHARP 2D technology and Eco Scan

Pioneers of CBCT imaging in the dental industry, NewTom creates solutions for clinical diagnostics. An efficient international distribution network, research and development spanning over two decades, and reliability have made NewTom a benchmark in 2-D and 3-D radiology. Its 5G Cone Beam 3-D imaging system, for example, is capable of scanning numerous anatomical areas, including the dental structures, small joints, and the maxillofacial and cervical regions. GiANO is a hybrid 2-D device upgradable to full 3-D.

Representing the engineering evolution of the NewTom range and its latest addition is VGi evo, which performs 3-D imaging, panoramic imaging, teleradiography and 2-D sequential imaging. The device introduces a new image chain, which includes features that increase standard CBCT performance, such as an enlarged flat panel sensor, with an improved signal–noise ratio and a rotating anode generator with a 0.3 mm focal spot.

Owing to 51 scan modes, NewTom VGi evo provides specialists with a system that adapts to the specific needs of different clinical applications. The field of view



ranges from 5 × 5 cm to 24 × 19 cm, which is recommended for head and neck applications. Examination of a large anatomical area up to 24 × 19 cm with just one scan enables planning of maxillofacial, aesthetic and orthodontic treatment.

NewTom has also introduced the innovative SHARP 2D technology, which enables VGi evo to generate a complete set of 2-D images (anteroposterior and latero-lateral cephalometric images). Moreover, it features the CineX function, a dynamic sequence of 2-D images for analysing swallowing, salivary ducts, the temporomandibular joint with contrast, and flexion and extension of the spine.

For safeguarding the health of both patient and operator, the device uses pulsed emission, which activates the X-ray source only when required, and a standard examination entails only 1.8 seconds of total exposure. In addition, VGi evo features the new Eco Scan mode (available for all fields of view) that, combined with SafeBeam technology, further reduces the dose.

Functional and aesthetic alternatives to metal restorations

Nano-hybrid composites have become the material of choice in the posterior region

Prof. Jürgen Manhart, Germany

Composites have been in use for approximately three decades as an aesthetic alternative to metal restorations in the load-bearing posterior region.[1] Early clinical data on composites used in the posterior region collected in the early 1980s was not encouraging, primarily owing to insufficient mechanical properties. The low abrasion resistance of those composite materials led to loss of restoration contours. Fractures, marginal deterioration and leakage after polymerisation shrinkage were other reasons for the limited longevity of those restorations.[2–5]

Predominantly in recent years, it has been possible to reduce these inadequacies greatly through further developments in composite materials and adhesive systems.[6] Nevertheless, the negative effects of polymerisation shrinkage, such as poor marginal integrity, insufficient adherence to the cavity walls or cusp deflections, are still the greatest problem with composite-based materials.[7] According to the type and size of the inorganic fillers used, composites can be categorised into[8] conventional macro-filled composites, micro-filled composites and hybrid composites.

With the introduction of innovative composite derivatives, particularly in the last 10 to 12 years, further classifications, for example by filler content (affects the viscosity of the composite) or by differences in the monomer matrix (classic methacrylates, acid-modified methacrylates, ormocers with an inorganic–organic compound matrix, ring-opening silorane systems), have increased in importance.[9] Composites are processed in incremental layers, usually in single increments with a maximum layer thickness of 2 mm. The individual increments are each polymerised separately, with exposure times of 10–40 seconds depending on the light intensity of the curing device and shade/translucency of the respective composite paste.

Direct composite restorations have become an essential, integral component in the therapy spectrum of modern restorative dentistry. They are used, among other reasons, because of the broad range of application, the conservative and adhesive stabilisation of the dental hard tissue, as well as the economical and time-saving procedure followed, in comparison with indirect restoration alternatives.[10]

The joint statement by the Deutsche Gesellschaft für Zahnerhaltung (German Society for Conservative Dentistry) and the Deutsche Gesellschaft für Zahn-, Mund- und Kieferheilkunde (German Society of Dental and Maxillofacial Sciences) on direct composite restorations in the posterior region (indications and longevity) in 2005 summarises the scientifically verified range of application of direct composites,[10] which are indicated for the restoration of Class I, Class II (including replacement of individual cusps), as well as Class V lesions.

Restricted indications include cases with restricted accessibility, limited imaging of the working area, unstable marginal adaptations or problematic proximal contact shapes, as well as cases involving insufficient oral hygiene (especially in interdental spaces) or severe parafunction and missing occlusal support of the antagonist tooth on enamel.

Clinicians should decide against the use of direct composites if patients lack the ability to achieve adequate moisture control (risk of contamination of the cavity with blood, saliva or sulcular fluid) or have allergies to the constituents of composites and adhesives.

Hybrid composites

Nowadays, hybrid composites are the material of choice when using a direct restoration technique for the permanent treatment of larger primary carious lesions or the replacement of older, insufficient restorations in the posterior region. Prerequisites are the correct use of the matrix technique and adequate moisture control of the cavity.[11] Hybrid composites contain a mixture of ground glass or quartz fillers with a particle size in the micrometre range and fumed silica microfillers. As the grinding technology for the production of glass fillers has consistently improved, a distinction can now be made between hybrid composites (mean particle size of < 10 µm), fine-particle hybrid composites (mean particle size of < 5 µm), ultrafine-particle hybrid composites (mean particle size of < 3 µm) and submicron-filled hybrid composites (mean particle size of < 1 µm).[9]

Owing to their filler technology and content, hybrid composites have the necessary physical and mechanical properties for successful clinically permanent restoration of even large anterior Class IV cavities and load-bearing posterior Class I and II cavities. Modern types with fine, ultrafine and submicron-filled particles now also ensure excellent polishing properties of the surface with long-term retention of the surface gloss. They can therefore be used for all Black's classes of cavity, which is the reason that they are referred to as universal composites. These composites can be applied either in a highly aesthetic polychromatic multilayer technique with different dentine, body and enamel shades, or in the incremental single-shade technique.

Nanotechnology-modified hybrid composites have been successfully established on the market for a number of years and represent an interesting new development based on the most recent research. Aside from ground glass fillers, they make use of nano-fillers that are similar in size to microfillers. However, the individual, non-agglomerated nanomers are more evenly distributed throughout the organic matrix. The filler content, as well as the excellent mechanical properties, corresponds to that of regular hybrid composites. Nanotechnology-modified composites are currently used as universal composites in the anterior and posterior regions.

Clinical case

The following clinical case describes the replacement of an amalgam restoration in the maxilla with the nano-hybrid composite GrandioSO (VOCO) using the single-shade layer technique.

A 39-year-old female patient visited our surgery with the wish to have her last remaining amalgam restoration, on tooth #16, replaced with a tooth-coloured composite restoration. The tooth was not sensitive to percussion and responded positively to a sensitivity test using a cold spray. After thorough cleaning with a fluoride-free prophylaxis paste and a rubber cup *(Fig. 1)*, the shade was chosen based on the moist tooth, while avoiding strong colour contrasts with the immediate surroundings and before applying the rubber dam *(Fig. 2)*. The reversible lightening process caused by loss of moisture on the tooth surface, as well as the strong contrast against the coloured rubber dam, would otherwise have made it impossible to select the correct shade.

Figure 3 shows the situation after the removal of the amalgam restoration. After excavation and the subsequent finishing of the cavity margins, a rubber dam was applied *(Fig. 4)*. The rubber dam isolates the operating site from the oral cavity, facilitates clean and effective work, and guarantees that the working area remains clean of contaminating substances such as blood, sulcular fluid and saliva. Contamination of the enamel and dentine would result in distinctly poorer adhesion of the composite to the dental hard tissue and endanger the long-term success of a restoration with optimal marginal integrity. Additionally, the rubber dam protects the patient from irritating substances, such as the adhesive used. The rubber dam is thus an essential aid to simplify the working process and ensure quality in the adhesive technique. The minimal effort required to apply the rubber dam is compensated for by avoiding the need to change wet cotton rolls and the patient's requests for rinsing.

The next step of treatment involved the application of the adhesive technique. *Figure 5* shows the application of ample amounts of the universal bonding agent Futurabond DC (VOCO) to the enamel and dentine. After it had been rubbed in for 20 seconds, the solvent was carefully evaporated with compressed air. Then the bonding agent was polymerised with light for 10 seconds *(Fig. 6)*, resulting in a shiny cavity surface evenly covered with adhesive *(Fig. 7)*.

This should be carefully checked before the restorative material is applied, since any areas of the cavity that appear dull are an indication that an insufficient amount of adhesive has been applied to those sites. In the worst case, this could result in reduced bond strength of the restoration and in reduced dentinal sealing, which may lead to postoperative sensitivity. Should such areas be found during the visual inspection, an additional amount of bonding agent is again selectively applied to those areas.

Fig. 1: Situation before treatment: old amalgam restoration in a maxillary molar. – Fig. 2: Shade selection with the composite-specific shade guide. – Fig. 3: Situation after removal of the old restoration. – Fig. 4: After excavation, the tooth was isolated from the oral cavity using a rubber dam. – Fig. 5: Application of the bonding agent Futurabond DC to enamel and dentine with a mini-brush. – Fig. 6: Light polymerisation of the bonding agent. – Fig. 7: The cavity, evenly covered with adhesive, has a shiny surface. – Fig. 8: First horizontal increment of GrandioSO composite and subsequent polymerisation. –