Novel biosensor for use on teeth

Daniel Zimmermann

The researchers from Princeton University researches have successfully tested a special kind of biosensor that could help to prevent disease by detecting even small amounts of harmful bacteria more quickly than conventional methods. Using a “tattoo” made from silk and gold and attached to a cow’s tooth, they were able to transmit a signal wirelessly to a nearby receiver.

With the method, developed in collaboration with the US Air Force and the American Asthma Foundation, the researchers hope one day to be able to detect not only bacteria but also DNA or particular viruses. In lab tests conducted at Princeton’s School of Engineering and Applied Science this year, they were able to detect pathogens responsible for surgical infections and stomach ulcers, among others.

The signals are received from a gold antenna on a tattoo that is attached to an array of graphene—very small particles of carbon—that triggers a signal when in contact with bacteria through attached proteins called peptides. Therefore, the device does not require any power supply, the researchers said.

The sensor is held in place by a water-soluble silk base derived from insect cocoons. In this way, the researchers said, the sensor can be used on different kinds of biomaterials, like teeth or skin, and washed away or dissolved by body enzymes after use.

According to the researchers, there is still a long way to go before such a biosensor could be in regular use, since the sensor is still too large to fit on human teeth and its lifetime and transmission distance are short. They admitted, however, that a few modifications to the design of the sensor could increase its transmission distance in the future.

Most traditional biosensors are based on substrates like silicon, which makes them heavy and uncomfortable to wear. 

Astra Tech backs up implant line

Astra Tech has presented new clinical data confirming the clinical effectiveness of its dental implant system. The results gathered through the company’s global research programme show almost 100 per cent survival rates for the company’s OsseoSpeed implants in sites like the posterior mandible.

Recent multicentre studies have also demonstrated the safety and predictability of OsseoSpeed 5 mm narrow implants and OsseoSpeed Profile implants, company officials said at the Astra Tech World Congress in May.

Since 2011, Astra Tech has been part of DENTSPLY, a US dental company that manufactures and distributes the ANKYLOS and XIVE implant systems through its German-based subsidiary DENTSPLY Friadent.
**DENTAL TRIBUNE Asia Pacific Edition**

**Dentists take part in military-led aid mission to Asia Pacific**

**International humanitarian campaign aims to provide treatment for more than 20,000 people**

WASHINGTON, DC, & SAN DIEGO, CA, USA: In one of the worst natural disasters in recent times, the Boxing Day tsunami killed more than 200,000 people in South-East Asia. Following the catastrophe, humanitarian missions organised by the Pacific Partnership have been conducted in the region each year since 2006. Recently, the first support troops including military dental providers were deployed from around the world for this year’s campaign.

According to Mission Commander US Navy Captain James Morgan, who spoke to reporters before embarking, the joint exercise will see repeated visits to regions and islands in Indonesia, the Philippines, Cambodia and Vietnam during the next two months. Up to 100 dental providers will be taking part in the mission, which is budgeted at US$20 million and expected to resume in early August.

“While at a host nation, I expect we’ll see anywhere from 60 to 100 patients daily, and sometimes, patients need more than one procedure performed,” commented William Robinson, a US Air Force major and dental provider from San Antonio.

Besides dental services like teeth cleaning and extraction, military personal will also provide other medical and engineering aid, as well as training to local medical professionals.

Approximately 1,000 professionals, both military members and civilians, are expected to join the mission, which, according to Captain Morgan, is supported by non-governmental organisations such as the San Diego Pre-Dental Society and intended to enhance international cooperation, as well as regional capability for future emergency response. Several countries, including France, Singapore and South Korea, are participating for the first time, he said. Besides the US, Canada, Japan, New Zealand and Australia have contributed resources regularly since the beginning.

The last mission in 2011 provided treatment to more than 21,000 patients.

The Partnership is hosted by the US Navy, which also provides major transportation and logistic support through the USNS Mercy, one of its two currently operating hospital ships. According to Captain Morgan, it will offer capacity for between 500 to 150 surgeries per day offshore and on land.

With almost 200 ships and more than 500,000 troops in the region, the US Pacific Fleet is currently the largest naval military power in the Asia Pacific region. During a visit to the region in November last year, US president Barack Obama announced his intentions to strengthen US-AP relations to promote stability in the region, of which the Partnership is considered an essential part.
Elexxion signs new distributor for Asian markets

**Dental Tribune Asia Pacific**

**HONG KONG/BADOLDZESEL, Germany:** Dental laser specialist elexxion has reported that it has signed a new distribution agreement with Global Dental Supplies in Hong Kong. The five-year contract will give the dental distributor the exclusive rights to distribute elexxion’s laser technology for use in dentistry in several Asian countries.

Currently, the German company sells its products through its subsidiaries and dealers in selected markets, such as India and Japan. The distribution rights for Hong Kong and Macau were previously held by Healthcare Dental, which did not renew its contract with elexxion after 2009, company officials said.

Besides elexxion dental lasers, Global Dental Supplies also distributes products from the German implant company BEGO, Sunstar, Bisco and GC, among others.

“With Global Dental Supplies we have a strong partner that gives us the opportunity to systematically expand our sales and marketing activities in Asia,” commented elexxion CEO Per Liljenqvist.

He said that his company could benefit from the agreement in terms of product registration and exhausting new distribution channels in the region.

The latest elexxion product offering includes the delos 3.0, a novel Er:YAG/diode laser combination indicated for a wide range of dental applications.

In addition, the company distributes the pico mobile diode laser and diodes, an Er:YAG dental laser device claimed to facilitate efficient hard-tissue surgical preparation and bone ablation tasks.

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**Regulation in Malaysia gets revamped**

Daniel Zimmermann

**PUTRAJAYA & KUALA LUMPUR, Malaysia:** Medical device regulations are being stepped up in Malaysia with the upcoming launch of a new governmental agency that will require local manufacturers and importers to have their products officially registered before they enter the market. The Medical Devices Authority, which will replace the current Medical Device Control Division, will operate under the authority of the Ministry of Health and be led by the country’s Director-General of Health.

As part of the 2011 Medical Device Act ratified by the Malaysian parliament late last year, the regulatory changes are intended to protect domestic businesses from patent infringement and patients from the health risks posed by low-quality devices. From November, all products will be classified into four risk categories, ranging from low to high. Ministry of Health officials commented. They said that non-compliant companies will be fined a maximum of RM200,000 (US$65,000).

To date, the registration of medical devices in Malaysia has been voluntary and imports have been largely uncontrolled.

Speaking to Dental Tribune Asia Pacific, Ultradent’s General Manager for Asia Pacific, Nicolas Sondaz, said that no official information had yet been communicated to the ministry with regard to dental devices. His company, which sells restorative materials and tooth-whitening kits, among other products, opened its Asian headquarters last year in Kuala Lumpur.

“The process of product registration has been quite slow in Malaysia,” he said. “We hope that the Ministry of Health will consider the size of the market and place the fee for each product registration accordingly.”

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² Based on sales.

³ Mean observation period 4 years IPS e.max Press, 2.5 years IPS e.max CAD.

See the IPS e.max Scientific Report Vol. 01 (2001 – 2011).

Based on sales.
Dear reader,

Daniel Zimmermann

When you are reading this words, I will have already departed to cover the 7th Congress of the European Federation of Periodontology in Vienna. Thousands of professionals involved in periodontology and dental implantology are expected to gather in the Austrian capital in June to discuss latest research results and concepts to fight periodontal diseases.

Although occasionally overlooked, the prevalence of those diseases remains one of the biggest challenges that all professionals in every field of dentistry have to face nowadays in daily practice. From orthodontic treatment to long-term maintenance of dental implants, almost every clinical success depends on a healthy periodontium.

Owing to deteriorating trends in health like the obesity epidemic with its wide effects in large parts of the US and Europe, this challenge is expected to rise considerably in the years to come, since periodontal inflammation and gum disease have been proven to be closely related to the general state of health.

Unfortunately, in many countries, periodontology still plays a minor role when it comes to dental education as well as the number of chairs and positions established at universities and dental schools.

In addition, interdisciplinary cooperation between periodontists and other fields of dentistry is still lacking, despite the fact that dental professional organisations recommended to check the periodontal status before starting any treatment.

The participation of many dental implant specialists at this Europerio is a ray of hope that the dental community is beginning to understand that their future is not only dependent on teeth but also on the tissue that surrounds them.

Yours sincerely,
Daniel Zimmermann
Group Editor
Dental Tribune International

Vaccination against periodontitis

From Seattle was the leader in periodontal vaccination research. They vaccinated primates with whole-cell P. gingivalis, and demonstrated partial protection against experimental periodontitis. Interestingly, they found that the levels of specific antibodies against P. gingivalis were high in all animals that were exposed to the bacteria, immunized and non-immunized, and antibody production was not able to explain the protection achieved.

Prevention of disease, in this case chronic periodontitis, is always better than cure. Developing a vaccine for periodontitis has been a hot subject for periodontal researchers. The old dogma was that the role of vaccination is to induce a humoral immune response, meaning protection by the production of memory B cells and antibodies against the pathogen. This dogma however is too simple. Recent evidence suggests that immunization can modulate the host response and shift the response, a key element in successful protection. The nature of the cellular response and which molecules are secreted by the site by these cells are critical to disease processes, as well as protection.

What is the process of developing a vaccine? First, we have to identify the key pathogens, and then identify and isolate virulence factors from the pathogens as candidate antigens. The candidate vaccine should be tested first in preclinical models followed by safety and efficacy tests in humans.

Eighteen years ago, a research group headed by Roy Page from Seattle was the leader in periodontal vaccination research. They vaccinated primates with whole-cell P. gingivalis, and demonstrated partial protection against experimental periodontitis. Interestingly, they found that the levels of specific antibodies against P. gingivalis were high in all animals that were exposed to the bacteria, immunized and non-immunized, and antibody production was not able to explain the protection achieved.

From then on, significant efforts were made in identifying molecules that are virulence factors in periodontal disease. Owing to deteriorating trends in health like the obesity epidemic with its wide effects in large parts of the US and Europe, this challenge is expected to rise considerably in the years to come, since periodontal inflammation and gum disease have been proven to be closely related to the general state of health.

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"...we still lack data from clinical trials in animals..."

Wim Crielaard
The Netherlands

Modern molecular analyses and in particular next-generation sequencing (NGS) techniques have revolutionised oral microbiology. Being able to analyse all oral bacteria, the oral microbiome, is of particular relevance and importance because it is well known that micro-organisms cooperate collectively in a polymicrobial ecosystem, causing chronic oral infections, such as periodontitis.

Studies of cultivable sub-gingival micro-organisms had already shown that the predominant bacteria in periodontal disease are Gram-positive facultative rods and cocci. In periodontitis, there is a decrease in the number of these “healthy” organisms and an increase in the number of “pathogenic” Gram-negative rods and spirochetes.

Indeed, culturing sub-gingival micro-organisms has provided considerable knowledge on the pathogenic bacteria associated with periodontitis, but unfortunately this has been limited by the fact that it focuses (by definition) on cultivable micro-organisms. As has beenunderstated frequently in the past, many oral bacteria cannot be cultivated and therefore conclusions are drawn on an incomplete picture. With this in mind, and because scientists started to realise that the polymicrobial ecosystem actively sustains oral health, even before NGS, molecular microbial analyses had been developed, which give a better, more complete overview of the oral microflora in health and during disease.

Many molecular microbial analyses have been targeted at a selection of (pathogenic) micro-organisms, but only open-ended approaches, where there is no selection for specific species to be detected, can be used for oral microflora studies.

The open-ended approach that has been most widely used for oral microbial communities and oral infections is the “Next Generation Sequencing” or clone-library approach. Indeed, by using this technique, several uncultivated bacteria have been associated with periodontitis, but after the first NGS study in which several orders of magnitude (i.e. millions) bacterial 16S DNA codes were analysed, it became clear that so far we had only explored the tip of the iceberg.

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Microbiological infections

Contact Info
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Aggressive and chronic periodontitis share many clinical features yet are also different in terms of development and progression. On occasion of Europerio 7 in Vienna this month, Dr Cristiano Tomasi from the University of Gothenburg in Sweden spoke with DTI Group Editor Daniel Zimmermann about the importance of early identification and why the identification of risk factors associated with both forms of periodontal disease remains difficult.

Daniel Zimmermann: Both chronic and aggressive periodontitis are complex infections. What is the basic microbiology underlying this disease?

Dr Cristiano Tomasi: Probably the most important microbiological feature is the establishment of a sub-gingival biofilm. The evidence suggests that periodontal disease is not related to a specific organism but rather to a complex environment of many different species that live in symbiosis. In a susceptible subject, the biofilm challenge will prompt a host response that will lead to the destruction of periodontal support.

It is estimated that between ten and 15 per cent of adults in developed countries suffer from chronic periodontitis. Are there any figures available for the aggressive form?

This question is not easy to answer. In fact, even for chronic periodontitis, prevalence differs significantly, depending on disease definition and the population studied. Furthermore, most epidemiological studies have only addressed the prevalence of periodontitis, with no distinction between the aggressive and chronic forms.

The range in prevalence when mild cases are included may reach 40 per cent in a population. The prevalence of the aggressive form, according to one study, was four per cent for localised forms and two per cent for generalised forms in a population ranging between the ages of 18 and 30. Other studies have suggested prevalence of severe cases in a young population of up to eight per cent.

Generally speaking, we still lack epidemiological data from studies that directly address this question. One of the main differences between both forms appears to be the age group in which they commonly occur. Age remains an important parameter for distinguishing the two forms. While severe cases at age 20 are commonly recognised as aggressive, those at 60 are mainly diagnosed as chronic. The diagnosis of
both forms, however, is clinical and basically follows the same steps.

A problem is that in many cases it is not actually possible to identify the age at which the periodontal disease started, so it is not easy to draw conclusions on clinical features related to age of onset.

What are the main challenges in differentiating between both forms?

I really think that the most important thing is to diagnose and intercept periodontits as early as possible. A screening probing can reveal initial periodontal destruction and signs of inflammation quite easily, allowing for an early and effective intervention.

Marking the fine distinction between aggressive and chronic forms could be another step, but the implications of these studies would be more interesting for researchers than for clinicians. If we are successful in our treatment, is it really important what we call the disease? And if we are not successful, do we blame the name of the disease?

One clinical consideration may be that the systemic use of antibiotics as adjunctive treatment is supported by studies on aggressive cases, but I think that with regard to the problem of microbial resistance induced by excessive use of antimicrobials, this approach should never be the choice for initial treatment, but be considered after re-evaluation to accompany mechanical retreatment of the remaining diseased sites. This view, however, is not shared by some periodontologists, who view the first treatment attempt as the important one.

Both forms of periodontitis share risk factors. What are the most common?

Periodontal disease is clearly the result of an unbalanced host response to the microbial challenge. It is therefore obvious that the genetic set-up of the host and the microbial composition of the biofilm are recognised as risk factors for the development of the disease.

Environmental factors like smoking and stress have also been correlated with the progression of the disease and its most severe forms.

It is a more difficult task to determine risk factors that are clearly associated with one of the two forms of the disease. A few studies have shown specific bacteria to be associated with aggressive forms, but others have also reported aggressive forms without the presence of those bacteria. The same thing happened with specific genetic polymorphisms. New insights are expected to come from epigenetic studies, in which the activation of specific genes is related to local environmental factors.

Environmental factors like smoking and stress have also been correlated with the progression rate. As I said before, the evidence for risk factors related to a specific form is still weak and the evidence not as strong as we would like it to be.

You have presented at the 7th congress of the European Federation of Periodontology. What can participants expect to take home from the presentation?

I hope to clarify the similarities and differences between the two forms of periodontitis. We will go through the most recent published results on those issues and try to sort things out as much as possible.

I see this as a real challenge. I will share my thoughts and my doubts on some questions that every clinician has to face on a daily basis.

Thank you very much for this interview.

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Conical internal connections will fuel future growth in European dental implant market

Dr. Karaman, Zamanian & Ian von den Dolder, Delta Research Inc., Canada

The dental implant and bone graft substitute market is the most rapidly advancing segment of dental technology, and leading competitors in this market must consistently develop new products supported by research from scientific and academic organizations to remain competitive. Recent cases have demonstrated that when companies lose a segment of support from the scientific community, their market shares tend to suffer significantly.

The European dental implant and bone graft substitute market has been further challenged by recent economic instability and the eurozone crisis, which has created a consistent demand for lower-cost dental implant products. As a result, many lower-priced competitors have begun to seize larger market shares in almost every European market. In many segments, these competitors are either regional or sourced from overseas markets such as Brazil, Korea and Israel.Degenerative products and barrier membranes have been particularly affected by consumer austerity, as these products are discretionary in many cases.

However, a growing number of consumers continue to demand high-quality products, guarantees of service and scientific improvements, which only premium manufacturers are equipped to offer. Conical internal connections are one such recent innovation, and currently constitute the fastest-growing connection type in the dental implant industry.

Many dental implant and bone graft substitute companies have looked to expand their product portfolio or create new markets while they create package deals to offset competition from rapidly emerging lower-priced competitors. Significantly, many European and US companies involved in this market have begun to invest in rapidly emerging periphery markets such as Turkey.

Increasing prevalence of conical internal connections

Dental implants are connected to final abutments in one of three ways: internal connections, external connections or stick-in devices in which the implant and abutment are already attached. Furthermore, internal connections have two sub-segments: butt-joint internal connections and conical internal connections.

Research has shown that a lack of intimate fit of the implant in the abutment or movement of the implant can provide an area for bacterial growth. Conventional butt-joint connections provide a connection that can result in micro-movement between the implant and the abutment, creating a pump effect for bacteria into the connection area. When bacteria are present in the micro-gap, they can cause inflammation, tissue recession and bone loss. Recent clinical studies have demonstrated that, on average, conical connections offer a smaller micro-gap than butt-join connections, in addition to a greater mechanical level of stability. As a result, conical connection types have become hugely successful in the dental implant market, and the majority of leading dental implant manufacturers have introduced conical internal connection products. Conical connection types will continue to represent one of the fastest-growing segments of the dental implant market.

Turkey one of the fastest growing markets in the world

Turkey is one of the fastest-growing dental implant markets, congruent with strong economic growth that weathered the recession far better than the US and nearly any region in Europe. The technology of dental implants in this country has advanced rapidly, as most of the major players in the European market moved quickly to gain a strong market share in Turkey. Additionally, this market benefits from low labour costs, which adds to the incentive for implant companies to establish domestic subsidiaries or local distribution partners, fuelling options for consumers. Turkey is also a popular destination for dental tourism, especially among patients from more expensive European markets. From 2008 to 2018, the Turkish dental implant market is expected to grow at a compound annual growth rate of 20.4 per cent.

EU medical tourism to strongly impact dental implant market

The EU directive on cross-border healthcare that comes into force in 2015 will have a strong impact on the European dental implant market. This directive will target the medical...
The D500 scanner series from 3Shape has been bundled with the company’s Dental System Standard software. According to the Danish manufacturer, the package provides a range of scanning and designing tools that dental labs need for entry to CAD/CAM for all the basic dental indications. This includes 3Shape’s flexible Sculpt Tools, the new telescope design workflow, 3Shape Communicate and the TRIOS Inbox, which connects the lab directly to the dentist using TRIOS digital impression taking.

The software is upgradable to Dental System Premium, which covers a number of additional indications. It can also be extended with the company’s wide range of add-on modules such as Adaptive Impression Scanning, the company said.

The D500 3-D scanner series has been developed for use in small to medium-sized labs that are looking for an easy and fast entry into digital processing. The compact device is built on 3Shape’s market-proven scanning technologies, including the three-axis motion system for complete capture of impressions, deep inlays and full undercuts. According to 3Shape, the D500 is one of the fastest entry-level scanners on the market and a cost-efficient choice without compromising quality and speed.

3Shape offers different pricing models for the D500 bundle to meet the requirements of any lab in any market. Lab professionals are advised to contact their local 3Shape reseller for pricing information.

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**Equity fund acquires Aussie lab biz**

**SYDNEY, Australia:** Southern Cross Dental Laboratories is seeking new growth opportunities in the Pacific and European markets with a deal that will leave private equity firm Ironbridge with a 60 per cent majority stake in the Australian company. The major transaction has a reported value of A$95 million (US$93.4 million) and is Ironbridge’s first investment in the dental industry.

The acquisition is also the closing investment in Ironbridge’s second investment fund, worth A$1 billion, through which the firm has already acquired a waste disposal business and service provider to the offshore gas and oil industry. In addition, the company has stakes in the private health care market, including hospital operations and pharmaceuticals.

Founded by Dr David Penn, a dentist and developer of dental appliances such as the Penn Composite Stent, Southern Cross currently provides laboratory services (including crowns, bridges and invisible braces) to dentists in Australia, New Zealand, Ireland and the UK. It also offers courses on dental procedures, including Invisalign and intra-oral scanning. In its home market, Southern Cross is estimated to have a market share of almost 30 per cent.

Penn told the *Australian Financial Review* that he will be leading the new holding together with Ironbridge’s Chief Executive Neil Broekhuizen. He said that, while Ironbridge will have a 40 per cent stake in Southern Cross’s previous business in Europe, it will be fully responsible for operations in Australia and New Zealand.

“We are growing nicely and there are some incredible opportunities,” Dr Penn was quoted as saying. “It was time to bring in a partner to help take the company to its next stage of growth.” Southern Cross’s business has grown by 20 per cent a year lately, according to Penn.
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2012
Extending the boundaries of feasibility in direct restorative procedures

A clinical case combining a high-performance material and clearly defined protocol

Dr. Gauthier Weisrock
France

Modern high-performance composite materials and standardised treatment protocols have led to more direct composite restorations being fabricated in the anterior region than ever. Even extremely challenging cases may now be treated chairside with predictable results and minimal loss of tooth structure.

A 24-year-old female patient presented at our practice with a request regarding aesthetics. She disliked the appearance of tooth #11, which showed severe discoloration after endodontic treatment. A clinical examination revealed that the root had been extirpated after an accident and that a fractured piece had been reattached with a composite material (Figs. 1 & 2). Upon radiological examination, it was found that the root-channel treatment had been performed correctly. However, a post had not been used.

Owing to the fact that approximately half of the original tooth structure had been lost, we opted for a direct composite restoration, provided that tooth whitening procedures could be successfully completed. Along the spectrum of possible treatments, this approach is located between “conventional” composite restoration and ceramic veneering and, therefore, appeared to be clinically appropriate.

The patient, whose primary concern were a natural tooth shade and minimal loss of tooth structure, agreed to the recommended procedure. We decided to use the nano-hybrid composite IPS Empress Direct (Ivoclar Vivadent) for this step. The access to the cavity was then sealed with a temporary material.

Preparation and application of the adhesive

Before proceeding with the adhesive cementation, it was necessary to protect the operative field from saliva or blood in the oral cavity. Therefore, we isolated the anterior teeth, including the canines, with a rubber dam. The expanded treatment area allowed us to assess the incisal line, and the size and shape of the adjacent teeth.

We checked whether the silicone key could be positioned exactly. (If required, interfering areas can be adjusted using a scalpel until a precise fit is achieved.) The enamel areas were etched for 10 seconds. After tooth-shape analysis, we concluded that the preparations were harmonious compared with tooth #21. In order to avoid a misinterpretation of the shade owing to dry adjacent teeth, the tooth shade was determined prior to any intervention and in daylight. The IPS Empress Direct shade guide was used for the determination of the enamel and dentine materials. We determined the dentine shade based on the cervical third and the enamel material based on the incisal third of the adjacent tooth. Particular attention was paid to the anatomical structure of the adjacent tooth and the various opalescent reflections visible on the incisal surface, since it was our aim to imitate these features. A layering diagram detailing all the materials that we planned to use was prepared. In this case, only four shades were used: A3/A2 Dentin, A2 Enamel and Trans Opal.

Subsequently, we created a palatal silicone key on tooth #11 with the appropriate shape and occlusion. Once in place intra-orally, this key helped to create the palatal wall of the restoration in one step. The key included the teeth adjacent to the tooth that needed to be restored and covered the incisal area.

Fig. 1: Severely discoloured tooth #11. — Fig. 2: The shape of tooth #11 was reproduced in harmony with tooth #21. The substance loss amounted to somewhat less than half of the tooth. — Fig. 3: After the bleaching procedure, the shade of tooth #11 was optimal. — Fig. 4: Prepared tooth #11 with cusp tip chamfer and straight, right-angle palatal margins.

Building up the palatal and proximal walls

As a first step, the palatal enamel was built up. A thin layer of enamel material (shade A2) of less than 0.5 mm was applied to the palatal key and smoothed out with a brush. Then the key loaded with composite material was placed in the mouth and the fit was checked again. If necessary, the material may be modified before it is polymerised for 10 seconds.

Subsequently, the adhesive was applied, while the adjacent teeth were protected with a metal matrix. We used the Excite F total-etch adhesive (Ivoclar Vivadent) for this step. Owing to the non-retentive preparation design and the fact that most of the restoration would be created on enamel, this type of adhesive proved superior to self-etching products. In order to facilitate penetration into the dentine tubules, the adhesive was gently massaged into the cavity walls. (After the adhesive has dried, the cavity must exhibit a glossy appearance; if this is not the case, the procedure needs to be repeated.)

The adhesive was then light-cured for 10 seconds with a blue phase curing light (Ivoclar Vivadent).

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The palatal wall created in the process showed the exact desired shade and did not touch the adjacent teeth (Fig. 5).

Applying a thin layer of enamel material (A2) to the proximal walls changed the complex cavity into a simple one. In order to create the thin layer, we fixed a transparent matrix in place with a wooden wedge, which allowed us to create the transition lines (the convex area that separates the proximal from the vestibular area)—the restorative outcome is influenced by the successful design of these transitional areas because it is not possible to design them with rotary instruments. We then applied composite material from the distal side of tooth #11, while tightening the matrix from the opposite side and polymerising the material in this position (Fig. 6). Thus, sufficient composite material could be added until the desired transition area was achieved. The mesial side was built up in the same manner (Fig. 7).

Building up the dentine core

Using dentine materials, a restoration is created that shows decreasing saturation from the cervical to the incisal and from the palatal to the vestibular area. In order to achieve this, a 3-D layering technique is applied, using materials with different levels of saturation. In our case, a material with a saturation one degree higher than the desired final tooth shade was applied. Therefore, dentine material in shade A3 was used in the area of the cervical margin.

The layer was applied to the palatal wall using a flat spatula suitable for composite resins (Fig. 8). Subsequently, a layer consisting of dentine material with a lower saturation was applied (shade A2). A pointed sili- cone instrument was used to design a slightly wavy margin covering half of the chamfer up to 1 mm below the incisal edge (Fig. 9). (If this technique is applied, the translucency of the enamel material becomes visible in the area of the incisal edge and the transition from tooth structure to composite material is masked.)

Each layer was polymerised with the bluphase curing light for ten seconds.
Designing the enamel portion

The opalescence effect was enhanced by applying a thin layer of Trans Opal material in the area of the incisal edge. Since the visible effect of this material is very intense, only a small amount could be used. An enamel layer (shade A2) was applied in several steps to the vestibular area, then contoured with brushes and cured for ten seconds. This enamel material covered the entire restoration (Fig. 10).

Finishing and polishing

The patient’s teeth exhibited a very pronounced macro- and microtexture (vertical pits and horizontal streaks, respectively). Imitating these features to achieve a lifelike reflection on the restorative surfaces was a challenging task.

This step was similarly important to determining the appropriate shade. We imitated the surface texture with fine-grain diamond-coated burs, using flame- and lens-shaped instruments (first with the red and then with the yellow colour code). The burs were used in the red handpiece without water irrigation.

Another important step was the finishing of the transition lines and the interproximal areas. It is advisable to use abrasive strips for this purpose because rotary instruments may produce flat areas that cause inappropriate reflections. OptraPol Next Generation polishers (Ivoclar Vivadent) with water irrigation were used for the polishing process. We always take great care to polish restorations perfectly whilst avoiding any damage to the surface texture we design. The polishing was greatly facilitated as a result of the extraordinary polishability of this composite material (Fig. 11 & 12).

Conclusion

Owing to high-performance materials such as IPS Empress Direct, which are consistently improving, and a clearly defined approach, we may use direct restorations for more indications than ever before, thus constantly extending the boundaries of feasibility. The advantage of direct restoration procedures is that they are time saving and conservative. Nevertheless, it may happen that directly restored teeth show discoloration again in spite of the perfect aesthetic outcome. In this case, another treatment is inevitable.

Dr Gauthier Weisrock is a dental surgeon from Marseille in France. He can be contacted at gauthier.weisrock@gmail.com.
“Lecture theatre” – a new interactive concept – on chairside CAD/CAM dentistry
An interview with Dr Michael Dieter, Ivoclar Vivadent, Liechtenstein

To be held for the first time in South-East Asia, the seventh CAD/CAM & Computerized Dentistry International Conference in Singapore in October will offer a detailed overview of the latest CAD/CAM technologies that are aimed at helping dentists achieve aesthetic and long-lasting all-ceramic restorations chairside. During a presentation in Cape Town, South Africa, Dental Tribune Asia Pacific had the opportunity to speak with Ivoclar Vivadent’s Dr Michael Dieter, head of the International Center for Dental Education who will be hosting the lecture theatre together with Jörg Vogt, international CEREC trainer for Sirona.

Dental Tribune Asia Pacific: Dr Dieter, your joint presentation with Dr Vogt in Singapore will be held in form of a lecture theatre. What is behind this concept?
Dr Michael Dieter: Jörg Vogt and I developed this concept two years ago. When the organizer’s managing director, Dr Dobrina Mollova, saw our performance at the sixth CAD/CAM & Computerized Dentistry International Conference in Dubai last year, she named it a “lecture theatre” because of its truly interactive nature. Jörg and I present in continuous dialogue with each other, which makes the lecture more interesting, not only for the audience but also for us.

Additionally, case demonstrations with the CEREC AC will be performed live on stage.

Primarily, our lecture is aimed at dentists who are interested in minimally invasive aesthetic treatment solutions who simply want to get into dental CAD/CAM technology. Our goal is to provide a guideline clinical treatment sequence for predictable treatment using chairside CAD/CAM technology. However, the lecture is also suitable for any dentist who is interested in all-ceramics as a modern restorative treatment option.

From my experience, I can say that many dentists still have little knowledge of what all-ceramic material they are supposed to use for various clinical situations. With our lecture theatre, we aim to demonstrate the main differences in terms of aesthetics, particularly for use in the anterior dentition, and the physical properties or strength of the various all-ceramic systems.

What do you think the reason is for this lack of knowledge?

Recently, we have seen the rapid development of materials and technologies. For the practitioner, it is sometimes difficult to keep up with all these new developments. This is why confusion preparation design compared with the traditionally used metal alloys or metal ceramics. If mistakes are made at the beginning, fracture of the restoration becomes much more likely. Therefore, preparation techniques for all-ceramics with regard to CAD/CAM application will be in focus as well.

What impact has CAD/CAM technology had on the usage of aesthetic restorations in the dental practice?
With CEREC, CAD/CAM technology has been available for chairside application for more than 27 years. This is a well-documented procedure with long-term clinical success. Today, there are 54,000 CEREC units in use, which demonstrates impressively that this technology is still driving aesthetic dentistry in the clinical practice.

What are the aesthetic limitations of chairside CAD/CAM?

In addition to the factors described above, cementation, particularly for glass-based ceramic restorations, is a clinical step of paramount importance for long-term clinical success, since it is directly linked to the aesthetic outcome and the fracture strength of the restoration. Which ceramics have to be bonded? Which ceramics can be cemented conventionally? How does one prevent post-operative sensitivity after cementation? All these questions will be answered in detail during the lecture.

What are critical factors for achieving successful long-term clinical outcomes?

Dr Michael Dieter

What are the critical factors for achieving successful long-term clinical outcomes?
For long-term clinical success, what are the critical factors for successful long-term clinical outcomes?

What are the aesthetic limitations of chairside CAD/CAM?

What are the aesthetic limitations of chairside CAD/CAM?
"...cemmentation is a very important factor and still underestimated by many dentists."

The main indications are inlays, onlays, partial crowns, fixed bridges and veneers. In addition, up to four-unit posterior bridges are now possible, either as a temporary solution with polymer blocks (e.g. Telio CAD, Ivoclar Vivadent) or as a permanent restoration with a high-strength zirconium dioxide/lithium disilicate material (e.g. IPS e.max CAD-on, Ivoclar Vivadent).

What are the aesthetic limitations of chairside CAD/CAM?

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