Titanium implants may carry risk of corrosion, study finds

DTI

BIRMINGHAM, UK: Titanium medical implants used in dental prostheses and bone-anchored hearing aids may be less robust than commonly believed. Researchers from the UK have recently discovered evidence to suggest that in environments where there is no significant wear process, microscopic particles of titanium can be found in the surrounding tissue, which may have a negative impact on the devices.

For the study, Dr Owen Addison in the Biomaterials unit of the University of Birmingham’s School of Dentistry and his team obtained tissue from patients undergoing scheduled revision surgery associated with bone-anchored hearing aids (BAHA) at University Hospitals Birmingham NHS Foundation Trust. Soft tissue surrounding commercially pure titanium anchorage devices was examined using micro-focus synchrotron X-ray spectroscopy at the Diamond Light Source, Oxford, UK.

“The results showed, for the first time, a scattered and heterogeneous distribution of titanium in inflamed tissue taken from around failing skin-penetrating titanium implants,” the authors reported. “Wear processes and implant debris were unlikely to be major contributors to the problem. In the absence of obvious macroscopic wear or loading processes, we propose that the titanium in the tissue results from micro-motion and localised corrosion in surface crevices.”

Globally, more than 1,000 tonnes of titanium are implant ed into patients in the form of biomedical devices every year. Metallic prostheses, fixation and anchoring devices are used extensively for dental, orthopaedic, and craniofacial rehabilitation and their effects on the body are widely

Coconut oil could reduce caries

Researchers from Ireland think that coconut oil may be of great interest to the oral health industry in the future because a new study has found that its natural anti-biotic properties strongly inhibit the growth of bacteria that cause oral infections. They suggest that the oil could be integrated into commercial dental consumer products to combat tooth decay.

In clinical tests, the researchers discovered that coconut oil that had been treated with en-zymes similar to those found in the digestive tract was most effective in blocking the development of most strains of Streptococcus mutans. Additional tests revealed that the same enzyme-modified variant of coconut oil was also harmful to Candida albicans, the yeast that causes oral thrush, among others.

DTI partners with publisher in Japan

The largest publishing group in dentistry has joined forces with Medial Tribune Japan, a leading publisher in medicine and dentistry, in order to extend its broad range of media and educational services to Japan. The recently formed partnership includes the establishment of an online edition of Dental Tribune Japan in Japanese, targeted at more than 60,000 dentists, with weekly news in the local language sections of www.dental-tribune.jp, as well as regular e-newsletters and educational programmes in collaboration with the global e-learning platform Dental Tribune Study Club.

Dental Tribune Japan will also be the official representative of all publications and services of the Dental Tribune International portfolio in Japan, DTI president Torsten Oemus said. He added that Japanese dental professionals, including researchers, dentists, dental technicians, hygienists and dental industry representa-tives, are invited to submit abstracts, articles, product reviews or other editorial content.
Debate about dental colleges in India heats up

NEW DELHI, India: In a letter to the state government of Maharashtra, the President of the Dental Council of India, Dr Dibyendu Mazumder, has recently asked the chief minister of the state to retract permission for a new dental college to be established at the Maharashtr University of Health Science. He warned that with increasing output of graduates from dental schools, there will be fewer and fewer patients to provide sufficient employment for dentists.

In Maharashtra, which currently has over 55 educational institutes for dentistry, Mazumder said that the dentist to patient ratio has fallen lately to under 1:5,000, a number lower than recommended by the World Health Organization. In addition, the state recently increased the number of positions available in its three state-run dental colleges with the goal to provide attract more students.

With this trend continuing, Mazumder said that more and more dentists throughout the country are at risk of becoming jobless and pursuing other professions that offer more security and a better income, for example, in the business process outsourcing or insurance sector.

The problem of having too many dentists is not only limited to India’s third largest state. In August, the government of New Delhi, for example, announced plans to expand the Maulana Azad Institute of Dental Sciences into a full university.

Back in February, the Kerala chapter of the Indian Dental Association also ran a campaign against the opening of new colleges in their state, which already has 20 dental institutions and a ratio even lower than that in Maharashtra.

Nationwide, dental colleges have mushroomed over the last few years, now adding 30,000 new dentists to an already massive dental workforce of 1.3 million, according to the Dental Council of India.

The organisation has sought to halt the trend by introducing regulations to make it more difficult, particularly for private entities, to open new colleges. For the next academic year, therefore, new institutes will only receive permission if associated with a nearby medical college. From 2015, all dental colleges will also have to be certified by the National Assessment and Accreditation Council in Bangalore, a governmental body for quality assurance in higher education.

However, experts say that these steps may already be too late and that there is time for a revised national strategy on dental education.

Dental experts warn that India is educating too many dentists.

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PRC’s Minister of Health receives first FDI award

Daniel Zimmermann
DT Asia Pacific

HONG KONG: The Grand Hall of the Hong Kong Convention and Exhibition Centre saw its latest highlight this month, when the FDI World Dental Federation officially opened its centennial congress with an eye-catching traditional performance featuring a 100-foot long dragon dancing among a sea of lions and flags.

The ceremony was attended by high-ranking officials from the Hong Kong Dental Association, the University of Hong Kong, among other institutions, as well as the Chinese and Hong Kong SAR governments, including China’s Minister of Health Zhu Chen, who also received the FDI World Oral Health Recognition Award, which was handed over by FDI President Dr Orlando Monteiro da Silva.

Chen, who has served in this position since 2007, is the first person ever to have received this award. According to the FDI, he was selected for his contributions to the development of dentistry in China, as well as his leadership in the education of new dentists and the establishment of new dental schools.

In his welcome speech, da Silva congratulated Chen, saying that the challenges the minister has had to overcome in the People’s Republic of China are a good example of the challenges his own organisation is confronted with in its goal to improve oral health globally.

With its “Vision 2020” document, introduced at a special forum during the World Dental Parliament, da Silva said that the FDI is able to provide not only a roadmap for the future of dental medicine, but also inspiration to the profession, preparing it for new and exciting partnerships in leading the world to optimal oral health.

Available for download from the FDI’s website, the document focuses on significantly improving access to oral health care worldwide by 2020 by expanding the role of oral health professionals and developing a responsive model for future dental education, among other things. In addition, the federation has launched two new websites in Hong Kong, both for its Global Caries Initiative, developed jointly with Dental Tribune International, and for its noncommunicable diseases campaign with the World Health Professions Alliance. The latter aims to help professionals, including dentists, to respond to the epidemic of noncommunicable diseases, such as cancer and respiratory disease. This year marked the 100th time that the FDI has invited dental professionals to its Annual World Dental Congress and it was the second time that it was held in Hong Kong. Thousands of dental professionals from the region and around the globe attended the event, which has been organised in collaboration with the Hong Kong Dental Association.

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A unique event in Asia

Tsvetan Deyanov Singapore

In October, all eyes will be on Singapore for the 7th CAD/CAM & Computerized Dentistry International Conference, which is to be held at the Marina Bay Sands Expo and Convention Center.

This remarkable networking event will bring together dentists, dental technicians and leading dental industry players to exchange knowledge and experience on the latest developments in dental CAD/CAM and computerized dentistry. Among other things, the dental technicians’ session will be well worth attending.

This tailor-made programme with a focus on dental lab technicians has been integrated into the two-day main programme for continuing professional education. It will focus on providing them with contemporary, technology-focused education and cover various aspects of using digital dentistry in the lab environment. Participants will learn how to take advantage of the latest digital technologies and the most up-to-date CAD/CAM methods and applications for CAD/CAM systems. The unique course will demonstrate key factors in increasing lab productivity and improving the efficiency of the dental team.

The parallel session on the second day of the conference will be dedicated to dental lab technicians, with presentations by professional speakers on the state of the art. In his presentation, “CAD/CAM technology—Flexibility at its best”, Lutz Ketelaar from DeguDent will review ten years of CAD/CAM in dentistry, including materials, production methods and indications. Patrizio Corso from Zirkonzahn will present quality, perfection, precision and an intelligent and wide variety of solutions in “Ready to face the future—Endless possibilities”. This will be followed by a hands-on course, “Digital functional prosthetics—Best practice”, by Barry C. Calkar from AmanRandhawa and a workshop on “IPS e.max CAD—technology that sets the new standard—STRENGTH and ESTHETICS combine” by Pitmun Intarotat from Ivoclar Vivadent.

The session will conclude with a lecture by Rik Jacobs from Vertex Dental entitled “Thermosens monomer-free thermoplastic denture base material”.

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Are you hiding any weapons off mass destruction?

Dr Peter Cooney Singapore

The appropriate use of different oral health promotion or preventive interventions and materials, as well as treatment options in public policy is crucial for the improvement of the oral health of dental and other health professionals.

Canada recently completed an oral health survey that established the current oral health status of Canadians and, in addition to describing the needs of the population, it established a baseline to which the effectiveness of any intervention can be compared. This assessment, along with an in-depth understanding of the dental public of individuals and populations. Whether one is a private practice dentist doing treatment planning or a public health dentist assessing the needs of a community, the approach is the same.

In order to assess which preventive and promotion intervention to use, it is utterly important to evaluate the needs and current oral health status of the individual or population first, as well as to conduct an assessment of the community. The oral health assessment would include the incidence of caries, periodontal disease, and oral cancer. The assessment of the community would include elements such as whether there is a community water system, whether the community is fluoridated and at what level, and the availability of dental health community and the particularities of a community, lays the necessary groundwork for determining the intervention approach to take.

In addition to understanding the needs of an individual or a population, it is also important to compare the reach, effectiveness and costs of an intervention in order to determine which intervention will have the greatest impact. For example, a community with a high incidence of caries and a viable central water supply may benefit from introducing water fluoridation. In terms of treatment options, an understanding of the individual or community of dental appliances may be the material of choice.

In summary, it is essential when making an intervention or treatment decision to evaluate and consider the results of a thorough needs assessment, the pros, cons and effectiveness of the proposed intervention, as well as the associated costs. This detailed planning from the outset will translate into health improvements in a population.

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Global oral health in the context of preventive or treatment interventions and materials

Dr Martin Gillis Canada

In September 2011, a UN High-level Meeting on Noncommunicable Diseases (NCDs) was held in New York City. This was a watershed moment in the global fight against NCDs with the adoption of a declaration by UN member states, meaning that all nations must take action against this global epidemic.

Oral disease, the most common NCD and one of the most expensive to treat, is a global public health concern. The political declaration notes that oral diseases “share common risk factors and can benefit from common responses”. Therefore, interventions and strategies to improve nutrition should have a positive impact on all NCDs, including the prevention and control of oral disease.

The World Health Organization will be the lead agency implementing prevention and control measures for NCDs; however, progress will require a multifaceted approach from multiple sectors. Partnerships are crucial to the success of future endeavours against NCDs. The FDI and IDF recognize this as witnessed by the release of “A call to action for integrated case management of the diabetic patient” during the 2007 Annual World Dental Congress in Dubai. This led IDF to create oral health resources for diabetes care providers and raised awareness about the importance of oral health in diabetes management.

Today we have the task of implementing the Political Declaration on NCDs by addressing complex issues such as poor nutrition. Mitigating this risk factor will help with the prevention and control of oral disease and type 2 diabetes. Now is the time for both federations to renew efforts for collaborative action on this global concern.

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Ivoclar talks dental ceramics at first international expert symposium

Daniel Zimmermann
DT Asia Pacific

BERLIN, Germany: Ceramic materials used in dental restorations have evolved significantly over the last 20 years. A review of the latest materials and their clinical use was presented last weekend at an international symposium organised by dental manufacturer Ivoclar Vivadent in the German capital of Berlin.

Opinion leaders and renowned clinicians from all over the globe attended the one-day event, held by the specialist company from Liechtenstein in this form for the first time. Under the theme “All-ceramics meets implant aesthetics”, they presented results from clinical studies and experiences from practice, demonstrating current applications and the potential of full-ceramic restorations fabricated using Ivoclar Vivadent’s IPS e.max all-ceramic system.

Introduced to dental markets over a decade ago, the system covers a wide range of indications, from thin veneers used in single-tooth restorations to crowns and wide-span bridges. According to Ivoclar Vivadent Chief Sales Officer Josef Richter, it is currently available in lithium disilicate and zirconium oxide and can be used for the press technique, as well as CAD/CAM technology.

Prior to the presentations, a round-table discussion, joined by Dr Christian Coachmann from Brazil and Dr Kenneth A. Malm–
ment from the US, among other experts, discussed different indications for dental ceramics and the long-term success achieved using such ceramics. The selection of materials was given particular attention and most participants agreed that this has a significant impact on clinical success.

Dr Manfred Kern from Germany, for example, presented a new study conducted on patients in Germany, demonstrating that success rates of three-unit fixed dental prostheses (FDPs) made from e.max monolithic lithium disilicate were comparable to those of conventional metal-ceramic FDPs. Similar results from studies involving the material were presented by Prof. Van P. Thompson from New York University’s Department of Biomaterials and Biomimetics.

"If we do not understand how to select the right material, it will be difficult to achieve any type of success," remarked Prof. Nitza Bichacho, head of the Ronald E. Goldstein Center for Aesthetic Dentistry in Jerusalem in Israel, who discussed parameters for durable and aesthetic tooth- and implant-supported restorations.

Other topics included treatment planning for complex implant-prosthetic restorations and communication aspects with regard to treatment procedures. In addition, Dr Yukio Kusama from Tokyo in Japan presented a new abutment design made from lithium disilicate press ceramics that is said to combine perfect biological function with better aesthetics.
Study questions preventive dental visit intervals

The researchers found that the second dental cleaning did not reduce the risk for tooth loss in low-risk patients, while high-risk patients benefited from additional dental care. Over the monitored period, only about 17 per cent of high-risk patients who had visited the dentist twice a year had undergone extractions, while more than 22 per cent of high-risk patients who had consulted the dentist only once in the same period had undergone extractions.

The preliminary results of the Periodontal Disease Prevention Study, conducted by researchers at the University of Michigan School of Dentistry in Ann Arbor, show that almost 14 per cent of patients who had one dental visit and about 16 per cent of the patients who had two dental visits had undergone tooth extractions.

The researchers enrolled approximately 5,400 male and female adults, who were mainly teachers from Michigan above 50 years of age, from a large dental database with more than 16 consecutive years of documented history. The participants had to provide DNA samples and information on possible risk factors, such as diabetes and smoking, in order to determine whether they were at a high or low risk of developing periodontitis. The researchers also used the PST Genetic Susceptibility Test, a genetic test developed by Interleukin Genetics, the collaborating company of the study, that analyses two interleukin genes for variations that identify an individual’s risk for periodontal disease, in order to identify individuals with increased risk.

Low-risk patients (47 per cent of the study population) were identified as non-smokers, genetically negative to the PTS test and with no history of diabetes. High-risk patients were defined as having one or more of these risk factors.

According to Dr. Lewis Bender, CEO of Interleukin Genetics, the data from the study appears to question the conventional one-size-fits-all model for preventive dental visits for adults, especially in the low-risk population.

“We believe that patients who have none of the major risk factors have a much lower progression rate for the disease. The frequency of cleaning in those low-risk individuals thus can be longer than in persons with a risk factor,” Bender told Dental Tribune.

The researchers estimate that 8 to 15 per cent of adult Americans have moderate to severe periodontitis, which can lead to tooth loss if the disease is not diagnosed early and treated properly. Other studies have associated periodontitis with heart attacks, strokes and other systemic diseases.

As the study data is still being analyzed for secondary endpoints, the researchers could not provide final recommendations yet. They are currently working on a manuscript and hope to publish the final result within the next six months.
The ability to examine the craniofacial anatomy with help of three-dimensional images obtained through Cone Beam Computerized Tomography (CBCT) has been praised as the new gold standard in oral surgery. Dental Tribune recently had the opportunity to speak with Prof. Stefan Haßfeld from the University of Dortmund’s Department of Oral and Cranio-Maxillofacial Surgery in Germany about the technology and its future potential at the FDI Annual World Dental Congress in Hong Kong.

Dental Tribune: Prof. Haßfeld, in your opinion, has CBCT become a standard in dentistry?

Prof. Stefan Haßfeld: CBCT has been available in dentistry for over a decade and since then has been established as a standard for many indications. Despite this development, I doubt that the technology will make traditional imaging obsolete any time soon. Instead, it will be used as an aid in more complex treatments.

One of the areas in which CBCT is used is implant treatment planning. What are the other main areas of application?

Nowadays, the technology is widely used in complex oral and maxillofacial surgery procedures. For example, we regularly examine large cysts and deeply impacted third molars with CBCT. Its use can also be of benefit for the diagnosis of maxillary sinus diseases, as well as in traumatology or the correction of anomalies and dysgnathias.

What potential does the technology offer regarding the improvement of treatment outcomes?

In contrast to traditional imaging, CBCT allows the human autonomy and pathology to be assessed in detail in 3-D space. This can be extremely helpful for treatment planning and the assessment of regions that present a surgical risk, like adjacent nerves, teeth or blood vessels. In many cases, we expect a significant reduction in operative risks and an improvement in surgical planning.

According to the industry, the radiation dose for patients is significantly lower with CBCT. Do you agree with this statement?

I would have to disagree, since compared with traditional imaging, CBCT usually has a higher radiation dose. However, it also yields completely different information. By taking a high number of single images from different angles, CBCT can provide lower radiation doses only in a few exceptional cases.

Is this the only drawback compared with traditional imaging techniques?

As CBCT has another field of indications, comparison with traditional imaging techniques is not appropriate. However, there are indeed some shortcomings, like higher radiation doses and costs, as well as a lower resolution compared with dental film.

What role will CBCT play in dental practices in the future?

CBCT will take root in dental practices, particularly in those with emphasis on surgery, when it comes to certain complex treatment issues. For all the mentioned reasons, traditional imaging methods will not disappear. A panoramic X-ray image, for example, provides an excellent overview of the entire jaw arch for clinically oriented examinations, with only little effort and at a small radiation dose. Dental film still offers the highest resolution for viewing details. Rather, the establishment of CBCT for dental imaging offers us additional options for daily practice.

Thank you very much for this interview.
Colgate-Palmolive extends oral health campaign

Dental Tribune Asia Pacific Edition

HONG KONG: International consumables manufacturer Colgate-Palmolive announced an extension of its Bright Smiles, Bright Futures oral health programme at the FDI World Dental Congress in Hong Kong. The programme will target more than 10,000 preschool children in 100 kindergartens from September onwards in order to promote better oral health care and to prevent early tooth decay.

As early childhood caries is prevalent among young children in Hong Kong, the company partnered with the University of Hong Kong to promote better oral health care in this age group. According to Dr Chun-Hung Chu, Clinical Associate Professor in Community and Family Dentistry and Assistant Dean at the university’s Faculty of Dentistry, a recent survey of 10,956 pre-school children receiving oral health treatment through the campaign revealed that about 40 per cent of those children were suffering from tooth decay. In almost all cases, the condition had been left untreated, he said.

“We are very proud to partner with the University of Hong Kong to continue Bright Smiles, Bright Futures in Hong Kong. With the support and expertise of the university’s scholars, our programme will use science to improve the oral health of preschool children through free education and prevention,” said Judy Chan, Associate Marketing Director at Colgate-Palmolive Hong Kong.

With the start of the new school year in Hong Kong, the manufacturer will be providing free training workshops for kindergarten teachers to equip them with adequate knowledge and skills in oral health care education. In addition, the company will be delivering oral health education programmes, including dental models, a cartoon video, posters, booklets, toothpaste and toothbrushes for children, to local kindergartens from next month onwards.

“Our aim is to make oral health care a part of the children’s daily routine in order to empower them to be responsible for their own oral health. The programme was thus designed to fit into the existing curricula of local kindergartens,” said Dr Marsha Butler, Colgate-Palmolive’s Vice-President of Global Professional Relations and Marketing.

According to Chan, the first phase of the campaign, which was initiated in September 2010 and reached over 10,000 preschool children, too, was very well received. “Over 95 per cent of teachers from about 80 participating kindergartens, who were surveyed during the first phase, were very satisfied with the programme. They agreed that they had learned ‘quite a lot’ or ‘a great deal’ about early dental health care,” she said.

Colgate’s Bright Smiles, Bright Futures campaign has reached more than 650 million children in 80 countries since 1991. According to the company, it is among the most far-reaching, successful children’s oral health initiatives in the world. The programme was developed by Colgate-Palmolive in collaboration with an advisory board of international educational dental experts and tested with children and teachers in the classroom.

“Four for over 40 years, Colgate has been committed to delivering oral health education to children around the world. This commitment to giving children the tools they need to make good oral health a permanent part of their lives continues in the Hong Kong community through the Bright Smiles, Bright Futures programme,” said Butler. “From the beginning, our company forged partnerships with different dental associations and institutions in order to raise awareness of dental hygiene at the earliest possible age by teaching children the basics.”

According to Chu, the programme will run for another two years.

Malaysia health group expands into dental care

KUALA LUMPUR, Malaysia: BP Healthcare has revealed plans to set up Malaysia’s largest chain of dental clinics over the next three years. Up to 50 dental centres will be opened nationwide until 2014, starting this month, the country’s largest provider of private health care services said.

The investment, worth RM100 million (US$52 million), is the company’s first venture into Malaysia’s growing dental health care market. In a press release, Deputy Chairman Chees Beh said that the clinics will operate under a new corporate entity called BP Dental, which he will lead, and provide restorative and advanced dental treatments, including implant placement and cosmetic procedures.

All clinics will be located at the company’s existing health care centres and equipped with state-of-the-art equipment, such as CBCT, Beh announced. He said that dental checks will be added to BP Healthcare’s Head2Toe health-screening programmes, which currently include screenings for cancer, as well as cardiovascular and infectious diseases.

According to its figures, BP Healthcare maintains over 50 diagnostic centres, as well as a number of laboratory, pharmaceutical and food testing businesses in Malaysia. Earlier this year, the group expanded overseas through a joint venture with the Ciputra Group, which runs a number of hospitals in Indonesia.

“Dental Tribune Asia Pacific: What does the recognition by the FSIDA mean for your company?”

China’s State Food and Drug Administration (SFDA), which also controls the quality of medical devices in the country, has recently approved the SuniRay digital radiography system produced by digital sensor technologies manufacturer Suni for the Chinese market.

Pascal Decoussemaeker: Suni Medical Imaging Inc.

Pascal Decoussemaeker: Registration in China will allow us to distribute the SuniRay on the Chinese market. The certificate issued by the organisation entitles us to sell the sensor to both the public and medical institutions in China. The product will be distributed through a network of local dealers, which we are now establishing.

Would you please explain the advantages of digital imaging compared with conventional X-rays?

To name only a few of the many advantages, it is much cleaner and more environmentally friendly. In addition, the images can be archived more easily than physical images, as the software allows retrieval of an image within a few seconds. Conventional images are also comparatively small. However, digital X-rays can enhance the diagnostic value of the images because they can be enlarged. Another advantage of the SuniRay in particular is that Suni is in a unique position to offer support to users because we are among the very few vertically integrated enterprises that design, manufacture, distribute and support their products themselves.

Thank you very much for this interview.

Dr. Marsha Butler, Colgate-Palmolive International

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“Registration in China will allow us to distribute the SuniRay on the Chinese market. The certificate issued by the organisation entitles us to sell the sensor to both the public and medical institutions in China. We have already received a number of inquiries from several Chinese companies who would like to distribute it. There is an abundance of partnership opportunities for us.”

“The SuniRay will be very successful in China”

Colgate-Palmolive extends oral health campaign

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Bosworth rebrands air-polishing unit, extends prophy powder range

DTI

Skokie, Illinois, USA: Bosworth’s air-polishing unit has been rebranded as ProphyBrite, the US dental manufacturer has said. With three new flavours, the company has also recently extended its line of sodium bicarbonate-based prophy powders, which have only been available in grape, spearmint and orange.

Bosworth introduced its Air Polisher to dental markets in March 2011. The device, currently available in red and black, cleans and prepares teeth prior to placement of orthodontic brackets, sealants, bleaching agents or fluoride through a slurry of sodium bicarbonate and water that removes stains, orthodontic cement and other debris like plaque. According to the manufacturer, the nozzle of the ProphyWhite is autoclavable and can be rotated 360 degrees for better access to the oral cavity. The device does not require any installation and connects to most four-hole coupler/air and water connections, the company also said.

Bosworth is offering the ProphyBrite in a kit that comprises the air-polishing body, two nozzles and powder-chamber caps, cleaning files, O-rings, as well as a sample of the company’s prophy powder, that the company says is less abrasive than prophy paste and is now available in six different flavours.

Besides the ProphyBrite and prophy powders, Bosworth also manufactures and distributes a number of different products for restorative dentistry and orthodontics.

3Shape strengthens support

DTI

Copenhagen, Denmark: With its 2012 version, 3Shape has extended the range of indications and tools for its dental CAD/CAM solution. In order to support users worldwide in terms of training and upgrading, the digital dentistry specialist company from Denmark is now also offering a new support package called LABcare.

According to 3Shape, LABcare was designed to help labs stay competitive in the market and protect their investments in the field of CAD/CAM. With the package, dental labs using Dental System will be entitled to annual releases of the system, as well as all minor updates. In addition, LABcare will give dental technicians the opportunity to receive ongoing training through online webinars, hands-on training courses and learning materials provided by the 3Shape Academy, as well as real-time local support through a 3Shape representative, the company said.

3Shape currently maintains five support centres throughout the world and offers support in 12 languages through 30 in-house experts.

Launched in 2009, 3Shape’s Dental System combines industry-leading 3-D scanning, CAD technologies and management software. The latest version, available since the end of last year, features a number of additions like the 3Shape Communicate software and the integration of the company’s TRIOS intraoral scanner. Along with the system, the company also launched a number of scanners suited for CAD/CAM manufacturing needs, particularly for small and medium-sized labs.
In dental restorations, it is desirable to have durable and strong bonding between resin composite and dental restorative materials. Weak bonding at the interface can be dramatically enhanced with a coupling agent.

Silane coupling agents, which are synthetic hybrid inorganic-organic compounds, are used to promote adhesion between dissimilar materials. They are used at promoting adhesion in silicabased materials such as porcelain. However, adhesion in nonsilica-based restorative materials such as zirconia, metals and metal alloys is not satisfactory.

A solution to this problem may be surface conditioning of the restorative materials. Currently, a widely used surface-conditioning method in dentistry is tribochemical silica coating. After this treatment, a silica layer is formed on the surface so that the silane coupling agent can react chemically to form a durable bond with non-silica-based materials. Moreover, this treatment increases surface roughness, which enhances micromechanical interlocking for bonding.

This review will discuss surface-conditioning methods and some new surface-conditioning techniques, silane chemistry, silanes used for dental applications and the limitations of silanes in adhesion promotion.

The silane monomer most commonly used in clinical commercial products is 3-methacryloyloxypropyltrimethoxysilane. This is pre-hydrolysed in a solvent mixture consisting of ethanol and water that is acidified with acetic acid.

The shelf-life for a single-bottle silane solution is relatively short. The solution will turn cloudy and, if not used, cannot be used for adhesion. Two-bottle silane systems have been developed to offer a more stable system. One bottle contains an unhydrolysed silane in ethanol and the other one contains an aqueous acetic acid solution. The two solutions are mixed for ten to 15 seconds. This process is thereby formed on the surface. A glass-like silica layer is thereby formed on the surface. A glass-like silica layer is thereby formed on the surface. A glass-like silica layer is thereby formed on the surface. After this process, the surface is coated with high fusing porcelain veeners and for intra-oral repair of fractured porcelain restorations before cementation. Low concentrations of 4 to 10 % hydrofluoric acid are used in clinical practice. When a porcelain surface is etched with hydrofluoric acid, the acid dissolves the glassy matrix of the porcelain. A microscopically porous and micro-retenive surface is thereby produced and micromechanical interlocking for resin bonding is enhanced.

New surface-conditioning methods

The quest for enhanced and durable bonding continues. Several new surface-conditioning methods are currently under investigation. Two in clinical practice are plasma fluorination and laser irradiation at high power settings. Therefore, appropriate laser settings for different ceramic surfaces is important to prevent formation of surface cracks.

Selective infiltration etching

In this method, a thin layer of a glass conditioning agent is coated onto the zirconia surface and is then heated to above the glass transition temperature. The molten glass layers infiltrate between the surface grains. After this process, the specimens are allowed to cool at room temperature. The conditioning agent is then removed by applying hydrofluoric acid and rinsing it off. This creates a new retentive layer for resin-zirconia bonding.

Silane chemistry

Functional and non-functional silanes

Functional silanes contain two or more functional groups that can react with inorganic matrices, for example ceramics, and are used for repair of, for example samples. The use can be used as coupling agents to connect dissimilar materials.

There is also a group of silanes called the non-functional silanes. They contain one reactive functional group that can react with inorganic materials. They are widely used for some specific surface modification of materials. In addition, there are bio-functional/cross-linking functional silanes that possess two silanol groups with three hydroxylable alkyl groups, which is deposits onto the zirconia surface. A heat treatment at 900°C is carried out. Boehmite undergoes a phase transition to β-alumina. Through this treatment, a micro-retenive surface is created that may increase mechanical interlocking for resin bonding.

Internal coating with porcelain

The zirconia surface is sand-blasted with alumina particles of 20 µm in size. Then, the surface is coated with high fusing porcelain, which is prepared by stirring the porcelain powder into an aqueous alcohol solution. The porcelain is fired at a high temperature in a vacuum. After the firing process, the surface is sand blasted again. A silica-containing layer forms on the zirconia surface. This enhances adhesion with a silane coupling agent, that is, siloxane linkage formation.

Chemical vapour deposition

In a chemical vapour deposition system, the zirconia surface is exposed to a vapour mixture of tetrachlorosilane and water. The chlorine radicals and a SiOy seed layer is deposited as a coating on the surface. The thickness of the seed layer is controlled by deposition time. This silica seed layer provides the reactive sites for the silane coupling agent.

Plasma fluorination

In a plasma reactor, the zirconia surface is exposed to sulphur hexafluoride plasma. An oxygen fluoride layer is formed on the surface. This layer may increase the reactivity of zirconia towards a silane coupling agent. However, the exact mechanism of the bonding formation between the zirconium oxyfluoride layer with silane is still unclear.

Silane coupling agents and surface conditioning in dentistry
Cross-linking silanes are used in the steel and tyre industries. Such silane is also incorporated with functional silane to increase the bonding and hydrolytic stability of resin composite to titanium.

**Silane activation mechanism**
Silanes can create a bond between inorganic and organic materials. A general formula for a functional silane coupling agent is \( Z-(\text{CH}_2)_n-\text{Si}-(\text{OR})_3-Z \) which is an organo-functional group that reacts with organic resin, (\text{CH}_2)_n, is a linker group, and OR is an alkoxy group. The alkoxy groups are activated by hydrolysis to form silanol (-SiOH) before they react with the surface hydroxyl groups of the substrate.

The first step of silane hydrolysis is the fast and reversible protonation of the alkoxy group at a low pH (5–7). Next, a hemispherical nucleophile substitution (S_n2) reaction at the silicon atom takes place. A nucleophile, a water molecule, attacks back-atom takes place. A nucleophile, to form a pentacoordinate transition state. A new bond is formed between the silicon and the nucleophile, and a bond is cleaved between the silicon and the leaving group, alcohol. This yields the product with an inversion of the configuration.

A suggested mechanism for silane hydrolysis is shown in Figure 1.

The silane hydrolysis rate depends on the steric (size) and inductive (electronic) effects of alkoxy groups on the silane. The steric effect is the dominant factor that affects the silane hydrolysis rate. This effect is best illustrated using a ball and stick model (Fig. 2).

As shown in Figure 2, the steric repulsion increases when the size of the alkoxy group is changed from a methoxy to butoxy group. The approach of ethoxy groups. Methoxysilanes are more stable than the fabrication of new restorations, unless damage due to a fracture is beyond repair. The clinical procedure for repairing ceramic restoration usually involves the following steps: roughening the surface with diamond burs, sand-blasting the surface, acid etching, silanisation and finally bonding to resin composite.

**Application of silanes in dentistry**

**Ceramic restorations and repairs**
Silane coupling agents are used in dental restoration, such as bonding of inlays, crowns and bridges. For most patients, repair is more economical and time-saving than the fabrication of new restorations, unless damage due to a fracture is beyond repair. The clinical procedure for repairing ceramic restoration usually involves the following steps: roughening the surface with diamond burs, sand-blasting the surface, acid etching, silanisation and finally bonding to resin composite.

Glass fibre-reinforced composites A relatively new group of dental biomaterials, the glass fibre-reinforced composites, is used in fixed partial dentures, removable prosthetics, periodontal splints and retention splints. The adhesion between the glass fibre and resin composite is improved by adding a silane coupling agent. The silane forms siloxane linkages with the surface hydroxyl groups of glass fibre. The organo-functional groups of silane react with the functional group in the resin composite. Thus, the bonding strength is increased between resin composite and glass fibre.

**Resin composite filling materials**
Nowadays, dental resin composites are composed of a resin matrix that contains monomers and cross-linking monomers, as well as a free-radical initiator, an inhibitor, colouring pigments, filler materials such as barium glass, silica, apatite and a silane coupling agent. The latter enhances the bonding between the filler particles and the resin matrix. The filler particles added to the resin matrix also improve the physical and mechanical properties of the resin composite. Moreover, the addition of fillers reduces volume shrinkage after polymerisation, and improves the aesthetic appearance and radio-opacity.

Titanium, noble metal and base metal alloys Titanium, noble metals and cobalt-chromium (base metal) alloys are commonly used for removable partial and complete dentures with a metal frame incorporated and metal-resin cement restorations. These metal and metal alloys, surface conditioning by sand-blasting using silica-coated alumina particles produces a silica-coated layer on the surface. Application of a silane coupling agent to the silica-coated surfaces forms a durable siloxane linkage. This is followed by cementation.

**Limitations of silanes as adhesion promoters**
Silanes are good at promoting adhesion between resin composites and dental restorative materials but there are some limitations to silane coupling agents.

The adhesion of silane coupling agents and non-silica-based restorative materials such as alumina, zirconia or metals is weaker than the silica coating of these materials. Therefore, a surface pretreatment with silica coating is required so that durable bonds (siloxane bonds) are formed between silica and silica-coated restorative materials. For noble metals or noble metal alloys, thione or thiol-based coupling agents are used to promote adhesion.

These coupling agents have different bonding mechanisms with various dental restorative materials.

**Current trends and future developments of coupling agents in dentistry**
Nowadays, other coupling agents (such as phosphorus-ester) are added to self-adhesive resin cements and adhesive primers, metal and alloy primers, and carboxylic acid primers used in dental restoration.

Plasphosphate ester bonds lose bond directly to non-silica-based ceramics such as zirconia. It has been reported that using this phosphoester can enhance the hydrostatic stability of silicon-oxy-siloxane bonds than using silane coupling agents.

The main problem of resin composites bonded to silica-coated restoratives remains the adhesion of the resin composite with the application of commercial silane coupling agents in the bond degradation over time under artificial aging.

In order to increase the hydrolytic stability of the bonding at the interface, novel surface treatments of restoration materials and the design of novel silane monomers can solve this problem. Silane coupling agents with long hydrocarbon chains are more hydrophobic than those with short hydrocarbon chains. The bonding at the interface layer is more resistance to water aging. These two approaches could resolve the problem.

It could be said that silane coupling agents can fulfill the clinical requirements for dental restorations. Nowadays, a standard laboratory protocol for dental restorations entails surface conditioning of dental materials, silanisation and cementation. Moreover, the design and ageing are important factors in biomaterials science.
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A graduate of the University of Minnesota, School of Dentistry, he is an accredited member of the American Academy of Cosmetic Dentistry and a Board Examiner for accreditation. Dr. Milnar maintains a full-time practice in St. Paul, Minnesota emphasizing appearance related dentistry.

He has published numerous articles about the direct placement of composites, shade selection and porcelain materials. Dr. Milnar is co-founder of the Minnesota Academy of Cosmetic Dentistry and has lectured extensively within the U.S. Armed Forces as well as internationally on the subject of direct composite restorations, shade selection and porcelain materials. He has been voted “Top Dentist” for the last several years in the Minneapolis/St. Paul Magazine.

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The surveillance of patients is a dentist's duty

An interview with Prof. Newell Johnson, Australia

Oral cancer poses a continuing challenge for dental practitioners worldwide. At the FDI Annual World Dental Congress in Hong Kong, Dental Tribune’s Group Editor Daniel Zimmermann had the opportunity to speak with Prof. Newell Johnson from Griffith University’s School of Dentistry and Oral Health in Southport, Australia, about the disease and new methods of identification and treatment.

Daniel Zimmermann: Oral cancers figures seem to be increasing worldwide, despite awareness campaigns run by dental organisations like the FDI. Are we in danger of losing the battle against the disease?

Prof. Newell Johnson: There is some good news. In countries that have long had the reputation of having very high rates of oral cancer, such as parts of France, India and Sri Lanka, the rates of alcohol and tobacco-related oral cancer are indeed falling. The same is true of the US, much of Western Europe, and Australia. Here rates are falling from a lower base.

In those countries or populations with traditionally very high rates, however, hundreds of thousands still die of oral cancer every year. In parts of Eastern Europe and the former Soviet republics, rates of these cancers are rising, we think, because of still high tobacco use, abuse of alcohol and a poor diet.

The other piece of bad news is that the incidence of cancers of the oropharynx (as opposed to the lip and in the mouth itself) is also increasing worldwide.

HPV has been identified as a growing risk factor for oral cancer. What part does the sexual transmission of the virus play in the development of the disease compared with more commonly known factors like smoking or drinking?

Certain types of the human papillomavirus are indeed strongly associated with cancers of the upper aerodigestive tract, particularly of the tonsils and base of the tongue, rather than in the mouth itself. These are the same viruses that we know cause cancers of the uterine cervix, penis and anus. It is generally thought that sexual transmission is involved. The evidence is largely circumstantial; that is, these cancers are more likely among younger adults, and there are associations with the number of sexual partners.

Fortunately—if that is an appropriate word—these cancers are more sensitive to radiotherapy, and the survival rates/treatment outcomes are better than for most other head and neck cancers.

For the past decade, there have been extensive knowledge and immunisation programmes against these particular papillomaviruses delivered to girls in many countries. These are intended to prevent cancer of the uterine cervix in later life. It will be very interesting to observe, in another 20 years or so, whether this has had an impact on upper aerodigestive tract cancers too. Fortunately, we are beginning to see boys now included in the immunisation programmes in some countries.

Some forms of oral cancer have a patient survival rate of only 10 percent. What makes it so difficult to achieve a more successful therapeutic outcome?

The average survival at five years after diagnosis for oral cancer has hovered around 40 to 50 percent for decades in most countries. In the high-volume specialised treatment centres, patients are indeed doing better, in terms of long-term survival and quality of life; minimisation of disability and side-effects. The major reasons that we are not doing even better is because so many cancers are diagnosed and treated too late, and/or patients have severe co-morbidities such as diseases of the cardiovascular system or cancers at other sites.

Dentists can play a vital role in the identification of early signs of oral cancer. Is the profession sufficiently prepared for this role?

Well, of course one cannot generalise. Many dentists and other members of the oral health team carry out excellent surveillance of each patient. This is indeed our duty. It might be called “opportunist screening”. Many national dental associations, and the FDI, vigorously promote such behaviour. There are many excellent training programmes for the detection of patients and lesions at risk. This should go hand in hand with support from dentists for tobacco prevention/cessation, moderation of alcohol consumption, promotion of healthy diets and good hygiene (oral and sexual) for all their clients.

On the other hand, the prevalence of potentially malignant disorders, and certainly of overt oral cancer, is low in many countries, so maintaining a high level of awareness and interest among general practitioners is difficult. Some are discouraged by the long time between the first cancer screening may not be a remunerable activity.

In South Asia, and emigrant populations therefrom, potentially malignant oral disorders are common, and we have much activity with the NGOs and the public in these parts of the world. Recently, a study published in the Cancer Research journal has proposed a method of treatment by blocking a protein that plays an important part in the spread and return of oral cancer.

What are your views on resurgence and what are other promising therapeutic approaches?

There are very many biomedical therapeutic approaches in clinical development, maturation, migration and metastasis, and death of the cancer. Many are targets of investigation and manipulation. Some will prove irrelevant—or at best epiphenomena. Interference with some will also affect normal tissues, especially if they represent exaggeration of pathways that are part of normal cellular controls.

An attraction of this particular work is that it seeks to understand pathways critical to stem cells—those cells that provide the basis for continued cell renewal. At the moment, the observations on this pathway in human cancers have been experimentally verifiable. It is in some way from human treatment trials, though there are many human analogues of other putative biological treatments for oral and other cancers. In principle, this is the way forward.

There are a number of oral cancer-screening systems available on the market but their penetration is still very low. Why is this technology not yet part of dental practice?

For cancers, and for potentially malignant disorders, in the mouth itself, direct visual inspection and palpation, followed by referral or biopsy, is the best approach. Adjuvant screening tests have not been demonstrated to have utility beyond this and commercialisation can be counterproductive.

You have already mentioned genetics. What role will it play in the evaluation of oral cancer in the future?

Well cancer is, of course, a genetic disease. There is a small component of inherited genetic susceptibility, but nothing as important as with breast cancer, for example. There is a large component of acquired genetic abnormality, which is being gradually unravelled. So genetic testing is of increasing importance, perhaps for susceptibility, more so for early changes in the tissue during carcinogenesis, the latter perhaps detectable in saliva or blood too.

However, every cancer is a unique biological event in an unique individual with the spectrum of genetic abnormalities in the individual patient, and targeting these with particular designer drugs, or gene therapy or immunotherapy is exciting; we are in the early phase of this medicine.

Extensive surgery, radiotherapy and chemotherapy have not brought the improved outcomes we so desperately need. For the afflicted, the future will be individualised biotherapies. For the world, the future must be primary prevention.

Thank you very much for this interview.
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Building up the perfect tooth with composite resins

The natural appearance of a tooth can be successfully reconstructed with a composite resin that is based on an integrated shade and layering system. Restorations of this kind blend in seamlessly with the natural dentition in accordance with biomimetic principles.

Selecting a material suitable for the task, at hand is essential to a successful outcome. The shade range of IPS Empress Direct composite resin (Ivoclar Vivadent) comprises five dentine materials and five enamel shades (high opacity) and five matching enamel shades (high translucency).

Stronger and more translucent shades are also available, some of which are opalescent, for designing the lateral enamel areas and incisal edges. This well-rounded range of shades and layering materials facilitates the creation of natural-looking restorations using composite resin.

The following article describes the fabrication of a composite resin restoration in an anterior tooth using IPS Empress Direct. The procedure is described chronologically, starting with shade selection and ending with the final design adjustments.

The appearance of the upper anterior teeth in the presurgical situation was unsatisfactory. Tooth #11 looked particularly unattractive and neither its shape nor shade met the standards of a high-quality dental restoration. In order to obtain a clearer understanding of the presurgical situation, a greyscale image was produced (Fig. 1), illustrating the insufficient brilliancy and lack of translucent areas.

In addition, surface structures and their various transitions, as well as wave-like white striations, were visible. From the incisal aspect, the vestibular contour looked distinctly uneven (Fig. 2). As a result, the right incisor leaned towards the labial aspect. The wing effect of the teeth in this particular case could therefore not be reconstructed. Consequently, tooth #11 looked out of place.

The shade system of IPS Empress Direct comprises various dentine shades with high opacity. They are suitable for achieving bright effects (Bleach L/XL) or providing complete coverage (IV 5/6F). The system also includes matching enamel materials with more translucent Bleach and Incisal shades, as well as shade components called Trans Opal (opalescent).

A straightforward method was used for gaining a general impression of the shade layers of the neighbouring natural tooth. Various shade samples of IPS Empress Direct were applied to the untreated enamel surface of the adjacent tooth—in this case tooth #21—and polymerised (Fig. 3). Shade variations could be eliminated owing to the polymerisation process.

The prepared tooth was then illuminated from various angles with an operator’s light, which gave us a good idea of what the individual shades would look like in the mouth of the patient. The shade impressions obtained in this way provided us with valuable information regarding the shade behaviour of the composite resin system in use and the shades required for building up the restoration. In the present case, for example, the opalescent material Trans Opal was applied to the sides of the restoration in order to imitate the bluish-white areas of the adjacent natural tooth.

Build-up and layering of the basic shape

After the old restoration had been removed from tooth #11, the first increments were placed (Fig. 4). In order to imitate the saturated and intensive shade (opacity) of the neighbouring tooth, dentine shade A5 was placed at the base of the restoration. In addition, dentine and enamel shades A2 were applied in the incisal area. A lighter shade was required in the cervical region and therefore layers of dentineshade A2 were applied. Enamel shade A2 was placed on the sides (distal, mesial) of the restoration in order to impart greater brightness to the tooth.

Figure 5 clearly shows the different layers (the shade designations have been projected onto the image). Owing to the dehydration of tooth #21, the shade had already changed compared with the samples shown in Figure 3, which was an important reminder of the fact that shade selection must be done very quickly, since the neighbouring tooth no longer provided a reliable shade reference once dehydrated. The built-up materials were covered with a coating of Flow A2 and the vestibular surfaces were created.

Tooth #11 was consequently built up according to the layering protocol described. The aim of this step was to imitate the shading of the neighbouring tooth and create the basic shape of the restoration (Fig. 6).

The incisal area of this roundish tooth shape, however, was difficult to recreate. The mesial edge was quite angular and only transitioned into the rounded body of the tooth towards the distal aspect.

In this case, it was necessary to exaggerate the contours of this area when the composite was placed. This created ample scope for finishing the restoration. In all cases, the convex and concave areas had to be carefully finished, which is often difficult to accomplish in the first attempt.

The functional parameters were also considered in this process. This approach had been shown to be very effective in routine practice work. If time resources are limited, for example, patients can be discharged with this type of preliminary solution. The final layering procedure takes place at a later stage. Before the patient leaves the practice, however, the surface of the build-up should be coated with a flowable product in order to give the patient a comfortable feeling in the mouth.

Customised shading

The restoration build-up was completed with different shades from the range of composite resin materials. Mamelon-like depressions were cut into the surface of the preliminary shaped and shaded restoration with a finisher (red code, fine grit) using the cut-back technique (Figs. 7 & 8). The individual shade effects were created at these grooves at a later stage with the inlay...
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structure.

The neighbouring regions, which could cause an undesirable greyish transitional zone. The prepared vestibular tooth surface was filled with the selected flowable shades.

The shades of Tetric Evo-Flow (Ivoclar Vivadent) exhibit various whitenish opacity levels. Different shade values, ranging from yellowish (Bleach I) to bluish (Bleach L), are available. Bleach XL contains titanium oxide fillers and is therefore the most densely filled product (Fig. 10). The wide spectrum of shades enables the creation of fine shade nuances. In the present case, the surfaces between the mamelons were filled, beginning with the deepest point. For this purpose, the flowable material was placed and then moved into the areas to be filled with a probe tip. This procedure prevented the formation of bubbles. Various levels of opalescence were created (T, Bleach L, I, M, XL). If a highly translucent shade such as Bleach L is used, the grey value is increased to achieve a greyish inter-mamelon area. In order to illustrate the shade design more clearly, a shade map projected onto the image is shown in Figure 11.

Finally, the restoration was coated with a flowable layer made with Transpa material. In situations in which various shades are required to merge with each other, the flowable materials can be mixed with each other on the tooth surface. However, close attention must be paid to preventing the inclusion of air bubbles.

The morphological integration of the restoration was successful. The view from the incisal aspect clearly shows the wing effect of the butterfly teeth and an even vestibular contour (Fig. 13), resulting in a natural appearance. The incisal-osseous contour was adjusted with a file from the EVAsys (KaVo) and the final evaluation of the composite build-up was carried out by looking at the tooth from different angles (Fig. 14).

The light reflecting bands at the sides are a reliable indicator of the proper anatomic shape of the restoration and are responsible for the 3-D effect of the tooth. These side areas were created by a ridge that results from the transition between the vestibular surface and the interdental area. As shown in Figure 12, it is particularly important to round the distal side of butterfly teeth.

The success of a composite resin restoration primarily depends on the appropriate reconstruction of the tooth morphology. The recreation of natural shade effects should be given equal attention. The resulting restoration will blend in smoothly with the surrounding dentition also in terms of biomimetics. In the case of complicated shapes, the contours of the neighbouring tooth should be copied as faithfully as possible. A 3-D design is a prerequisite for ensuring the overall integrity of the restoration.

The incisal edge contours, as well as the mesial and distal contacts, are important for establishing the appropriate tooth shape. Modern materials allow discerning professionals to restore even very complex shade cases with composite resin layers. For this purpose, a composite that is available in true-nature shade components is requisite. Additionally, the cut-back technique simplifies the layering process, providing ample design freedom.

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“Exploring the capabilities of this frequently used yet underestimated organ”

Mouth Factory is a unique artistic project that explores the capabilities and versatility of the oral cavity through a series of functional machines designed to be operated by the user using his or her mouth. The tools were created by Cheng Guo, a young Chinese designer and artist, who studied industrial design at Tongji University in Shanghai and recently obtained a Master of Arts degree in Product Design at the Royal College of Art in London. DT Editor Claudia Duschek had the opportunity to speak with Cheng about his exceptional creations, which have already been exhibited in London and Milan.

Cheng Guo: How did you come up with the idea of tools that can be controlled with the mouth?  
As you can see, my collection of tools is neither particularly functional nor very efficient. I regard them primarily as performative devices. Through operating the tools, I’d like people to reflect on the reciprocal relationship between them and objects in their surroundings and other ways in which they could use these.

Claudia Duschek: How did you consult a dentist on the design or possible risks of using the tools?  
Did you consult a dentist or other experts to advise you on avoiding damage to the oral cavity? I always start out by imagining the parts. I use basic hardware tools for the die using his or her tongue to shape the rotating material. The 3-D model is then taken to the metal workshop to assemble the parts. I use basic hardware computer software to develop the tooling in 3-D first, in my head. After drawing a rough sketch, I receive advice from other experts like musicians and glass blowers, as well as several dental surgeons. In addition to obtaining advice about avoiding damage while operating these tools, I tried to learn more about taking advantage of physiological defects or diseases, translating them to functional usage. An example is the teeth lathe derived from my observation and study of malocclusion. More specifically, Angle’s Class III malocclusion gave me a lot of inspiration and my initial idea was to use the lower incisor to substitute the blade.

Blowing rotomoulding machine.

Cheng Guo demonstrating the chewing drill. (DTI/Photos courtesy of Grey Chen and James Champion)
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