

today

IDEM 12th International Dental Exhibition & Meeting • Singapore • 7-9 October 2022



Interview

Matthias Kuepper, managing director of Koelnmesse in Singapore shares insights into first in-person IDEM after four years.

» page 3



Market report

The total volume of global dental imaging procedures is increasing every year, and most of that growth is in the CBCT segment.

» page 6



Dental products in focus

IDEM Singapore will be an excellent opportunity to see the most up-to-date technologies and achievements in the field of dental medicine.

» page 14-18

IDEM Singapore makes grand return this year

Leading Asia Pacific dental exhibition and conference finally back to its in-person format

■ This year, the International Dental Exhibition and Meeting (IDEM) is being held from 7 to 9 October at Sands Expo and Convention Centre at Marina Bay Sands in Singapore under the theme “Building Resilience in Dentistry”. Organised by Koelnmesse and the Singapore Dental Association (SDA), IDEM 2022 features over 30 scientific conference sessions, including hands-on workshops, a full-day masterclass and exhibits, complemented with hybrid elements to ensure a holistic experience for all participants.

“As organisers of IDEM, we are excited to bring back the exhibition and conference in person after four years. While continuing education has been ongoing digitally, based on feedback we have received from our partners, exhibitors and delegates, the in-person experience cannot be replaced. A physical event will ensure that participants will once again get to connect face to face with speakers, exhibitors and peers to learn about the latest developments in dentistry,” said Mathias Kuepper, the managing director of Koelnmesse.



live and pre-recorded, conducted by 28 local and international speakers. The online conference covered a wide array of topics, which provided something for every dental practitioner. The digital event also featured several networking activities for all attendees, including three networking nights, a leader board competition

organised by Koelnmesse and the SDA. A total of 6,658 booth views in the digital exhibition hall were generated during the period.

In January 2022, Koelnmesse and the SDA announced the postponement of this year’s IDEM Singapore to October owing to the travel and safety restrictions in place at the time in the Asia Pacific region. They stressed the importance of dental industry professionals being able to travel to Singapore to attend the event in person.

Now, IDEM 2022 participants can look forward to a comprehensive and exciting event programme. This includes a full-day SDA masterclass featuring a lecture, titled “Implants in Stage III and IV periodontitis patients: Benefits and risks”, delivered by Prof. Maurizio Tonetti from the Shanghai Jiao Tong University School of Medicine in China.

The trade exhibition is taking place in a 14,000m² exhibition hall and showcasing approximately 500 exhibiting brands from over 30 countries, including more than 40 new international exhibiting companies participating for the first time in IDEM. In addition, the exhibition is hosting long-standing pavilion partners from Germany, Switzerland and the US, as well as returning and new sponsors.

Attendees can also look forward to a symposium held by the Asso-

ciation for Oral Health Therapists (AOHT) in Singapore in collaboration with IDEM. The symposium brings together two cornerstone events, the AOHT annual congress and IDEM’s Dental Hygienist and Therapist Forum.

New IDEM highlights

IDEM 2022 features an exclusive on-site Singapore Speaker Series covering a carefully curated selection of topics on comprehensive, conservative approaches to dentistry.

“We have curated a slew of exciting conference sessions for IDEM 2022 and are excited to introduce one of the brand-new programmes, the Singapore Speaker Series, to

showcase our local speakers. The IDEM conference will provide participants with the opportunity to learn about the latest in clinical research and pick up practical skills as well,” noted Dr Lawrence Yong, president of the SDA.

Additionally, the event is providing IDEM360+, a new digital community platform that offers participants more opportunities to network, connect, share and learn information before and after IDEM 2022. IDEM360+ enables participants to do business matching, find networking opportunities with the on-site lead generation feature, book meeting slots, watch on-demand content and more. IDEM360+ also marks a shift towards sustainability for IDEM. In a bid to reduce bulk printed materials, the IDEM360+ digital platform and app can be used as an all-in-one tool for scheduling and navigating the event.

Finally, attendees have the opportunity to experience the Innovation Arena, a novel initiative that aims to nurture young companies to grow with IDEM and assist even those in non-dental industries to expand their network at IDEM 2022. The Innovation Arena features insightful presentations showcasing the latest innovations and products targeted at the dental market.

today ▶ page 2



From 19 June to 19 August 2020, IDEM was conducted online for the first time owing to the COVID-19 pandemic and the related restrictions on in-person events. According to the organisers, 3,615 attendees from 54 countries and 304 exhibitors from 36 countries participated over the period. The conference featured a mix of 27 conference sessions, both

and an online business matching programme.

As for the virtual exhibition part of the event, Koelnmesse reported that 80% of the companies who showcased their products expressed that they are likely to recommend IDEM to their colleagues and friends and are likely to return to another event





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AD



today ◀ page 1

Programme highlights at a glance

Hands-on workshop Composite restorations—updates and concepts for aesthetic rehabilitation

- ▶ Presenter: Dr Christopher Ho, prosthodontist from Australia
- ▶ Date and time: 7 October, 9:00–12:00

Dr Ho will share step-by-step procedures to allow participants to master direct resin restoration via practical hands-on experience. Participants will learn how to perform predictable adhesive procedures, select shade for different materials, utilise different opacities of composite resin to sculpt a multilayered restoration replicating natural aesthetics, and visualise the anatomical form and morphology of teeth. Additionally, participants can expect to learn simplified and predictable techniques for direct placement, how to establish optimal posterior contacts with correct contours and how to finish and polish composite resin to a lustre finish.

Hands-on workshop Bracket placement, TAD insertion and deprogrammer placement

- ▶ Presenter: Dr Bader Borgan, orthodontist from the UK
- ▶ Date and time: 7 October, 14:00–17:00

In this hands-on session, clinicians will practise bracket placement protocols under the supervision of an expert. Participants will also have the opportunity to watch a demonstration of the insertion of temporary anchorage devices and deprogrammer placement on anterior and posterior teeth.

Hands-on workshop Leveraging on CBCT in endodontics: How it makes endodontics predictable and fun!

- ▶ Presenter: Dr Johnathan Wee, endodontist from Singapore
- ▶ Date and time: 8 October, 14:00–17:00

Dentists often find that the canal anatomy is not completely obvious, even with standard radiographs, and the diagnosis can be confusing when clinical and radiographic evidence do not correspond. The use of CBCT in endodontics has been considerably less widespread than in prosthodontics and surgical planning. CBCT is capable of being a serious force multiplier in endodontic diagnosis, planning, treatment and evaluation. Dr Wee will present the prevailing evidence and tips on how to employ CBCT equipment and capabilities to make endodontic outcomes even more predictable for dentists in this workshop.



IDEM opening hours

Conference opening hours:

- ▶ 9:00–17:30 on 7 and 8 October
- ▶ 9:00–16:00 on 9 October

Exhibition opening hours:

- ▶ 10:00–18:00 on 7 and 8 October
- ▶ 10:00–16:00 on 9 October

More information: www.idem-singapore.com ◀◀

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Publisher and Chief Executive Officer

Torsten R. Oemus

Chief Content Officer

Claudia Duschek

Editors

Franziska Beier
Jeremy Booth
Brendan Day
Anisha Hall Hoppe
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Copy Editors

Ann-Katrin Paulick
Sabrina Raaff

Designer

Franziska Schmid

Production Executive

Gernot Meyer

Advertising Disposition

Marius Mezger

Dental Tribune International GmbH
Holbeinstraße 29 · 04229 Leipzig · Germany
Tel.: +49 341 48474-302
Fax: +49 341 48474-173
General requests: info@dental-tribune.com
Sales requests: mediasales@dental-tribune.com
www.dental-tribune.com

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In-person IDEM 2022 to provide forum for robust exchange of ideas

An interview with Matthias Kuepper, managing director of Koelnmesse in Singapore. By Iveta Ramonaite, Dental Tribune International



“We are beyond excited to host IDEM 2022 in person after four years.”

Although held in a physical format, IDEM 2022 will also feature some hybrid elements. Why do you think this is necessary?

IDEM360+ is a digital community platform that adds another layer of experience to IDEM. The platform allows participants to do business matching, find networking opportunities using the on-site lead generation feature, book meeting slots, watch on-demand content after the actual event day and more. IDEM360+ digital platform and app will also be available after the event, and the trade exhibition will continue running virtually as part of the IDEM360+ Community. Attendees can continue to access useful information for their practices, and exhibitors can continue to engage and follow up with visitors beyond the event days.

opportunities and business growth to all participants. We are excited to be introducing a new programme, the Singapore Speaker Series, to showcase our local speakers. There is also a new initiative that aims at nurturing young companies from the dental industry, called the Innovation Arena, which will permit entrepreneurs to grow their network and explore different business opportunities with IDEM. This year, there is an increase in new exhibiting companies participating for the first time in IDEM, and we look forward to the dynamic and fresh ideas that these companies will add to the already robust exhibition.

Would you like to add anything else?

We are hoping to move towards being a more sustainable event, starting with this edition of IDEM. Taking

Matthias Kuepper is happy to welcome attendees to the in-person IDEM 2022, which will take place from 7 to 9 October at a new venue.

Mathias Kuepper is the managing director of Koelnmesse and has been helping to organise IDEM 2022, which is Asia Pacific’s leading dental show, for nearly a decade. Owing to the SARS-CoV-2 pandemic, the last edition of the biennial event took place online. However, this year, IDEM is back to its beloved in-person format, although it will continue to offer some digital elements throughout the event. In this interview with Dental Tribune International, Kuepper talks about event highlights and the selection of a new location and discusses the tremendous value that IDEM has for the dental industry.

What is the message behind the title?

With this year’s theme, we hope to provide a forum for a robust exchange of ideas as we navigate new challenges and explore the latest market trends. Our aim is to maintain competency, update and upgrade our knowledge and skills, and ensure relevance in our attendees’ clinical practice.

In this new edition, participants to IDEM 2022 can expect digital elements throughout the event. This will allow the participants to extend their learning beyond the event days and offer ample networking opportunities.

We are committed to maintaining high standards and providing our participants with the best experience for their professional development in order to meet the changing requirements and challenges of today’s dynamic environment.

Owing to the SARS-CoV-2 pandemic, the on-site IDEM 2020 was cancelled and the event was held online for the first time in its history. How do you feel about coming out of the pandemic and returning to the traditional in-person format this year?

We are beyond excited to host IDEM 2022 in person after four years. Although we hosted IDEM digitally during the pandemic, we have heard from sponsors, exhibitors and attendees that IDEM in a physical format is an experience like no other. They find it more effective and efficient to

connect face-to-face with speakers, partners, prospects and peers in order to learn about the latest developments in dentistry. In the meantime, it has given us more time to rethink formats



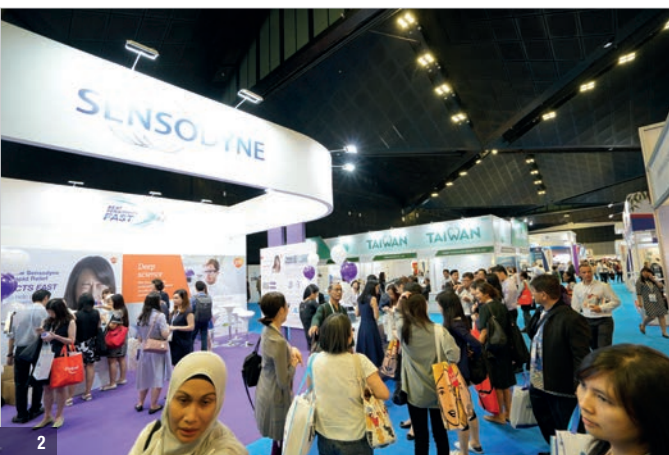
Figs. 1-4: Impressions from IDEM 2018.

What is unique about IDEM, and what should the attendees most look forward to this year?

As the leading dental exhibition and conference in the Asia Pacific region, IDEM gathers dental brands and experts from all around the world at one venue and offers networking

our first step towards this goal, the IDEM360+ digital platform and app will be used as an all-in-one tool for networking, scheduling and navigating the event, replacing the need for bulk-printed materials like exhibition and conference guides, venue maps and even name cards. ◀

The theme for this year’s event is “Building resilience in dentistry”.



Asian MICE business outperforms Europe

An opinion piece by Dr Björn Kempe, Singapore



shows great resilience to deglobalisation pressures.

The ASEAN market promises excellent business opportunities. There are free trade agreements in place, and ASEAN is destined to become one of the world's powerhouses. It has over 500 million citizens and a strong rising middle class, which will have a positive impact on dental business in the region. The Philippines, Thailand and Singapore are already offering first-class dental technologies and services to their citizens, and travellers worldwide also enjoy these destinations for medical treatments. I believe that Indonesia and Vietnam will be two major players and that the dental market will grow massively in these countries in the coming ten years.

I expect that the global trade show market will return to normal by 2024/25. European and German trade shows will take longer to recover. IDS will take place in 2023, but China has still not announced the reopening of its market. Japan has recently opened for business but not yet for tourist travel. We need to wait and see how the pandemic will develop in the coming third winter. One thing is certain: exhibitions have proved to be the right platform for industry leaders to come together. In-person events are even more important now than in 2019, and I am sure that many marketing departments will slowly realise that money spent on trade shows is perhaps more valuable than money spent on social media or other channels.

We are very excited about the next decade and strongly believe that Asia, the US and the Middle East could be the three most important trade show markets in the future. Europe is on the verge of losing its competitive advantage to other regions. It all depends on how Europe masters the crisis. However, I believe that the time of global mega-shows is over. It is now time for regional heavyweight shows like IDEM. You are at the right place! ◀

■ Welcome to IDEM Singapore 2022! Here, you will find that trade shows perform much better in Asia than in Europe. Although the International Dental Show (IDS) re-opened its doors in 2021 in Cologne in Germany, the show was only able to attract 40% of its original participants. IDEM 2022 in Singapore is one of the best and largest dental shows in the whole of Asia at a capacity attendance of almost 100%.

During the COVID-19 pandemic in 2020/21, many trade shows were not able to take place and only reopened at the end of 2021 or 2022. The global trade show calendar got a bit mixed up. Organisers tried to compensate for their losses by offering hybrid and virtual events. However, it is apparent that in-person events are the preferred choice and what exhibitors and visitors are really looking for.

In general, the European exhibition market opened up more slowly than the Asian one. Many shows in Europe are only welcoming back around 50%-60% of their original participants, whereas in Asia, the reopening traded at 80%-90% of the 2019 numbers for many organisers. In my opinion, one of the reasons for the strong demand in Asia is that Asia is a strong regional market and depends little on Europe or the US. In addition, the current logistical issues, inflationary pressures and geopolitical issues, including the current Russia-Ukraine war, are not pertinent to Asia and have a heavy impact only on Europe.

Although most of the skies are open and business travellers can already travel freely without COVID-19 testing requirements, in most Asian countries, the exchange between Europe and Asia remains limited. The increase in exhibitors and visitors comes from local or regional markets. At IDEM, you will witness a strong turnout of Association of Southeast Asian Nations (ASEAN) dental industry leaders and perhaps fewer European ones, since ASEAN has high economic power and



About the author

Dr Björn Kempe is the founder and CEO of Expos Asia, which is part of the Expos Global network and has its headquarters in Singapore. His consulting firm specialises in mergers and acquisitions, capital raising, investments, business development consulting and strategy consulting. Expos Asia also organises its own events in China and Indonesia.

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Dental imaging market: Product innovation to stimulate demand

A report by Dr Kamran Zamanian and Ali Shakerdargah, Canada

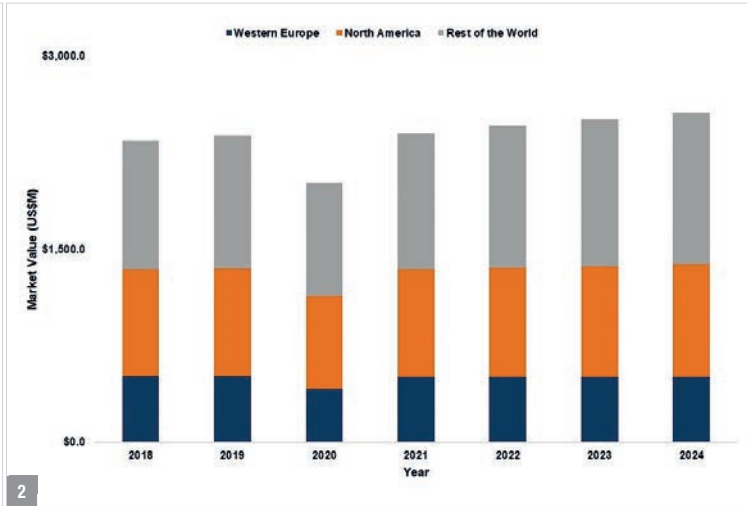
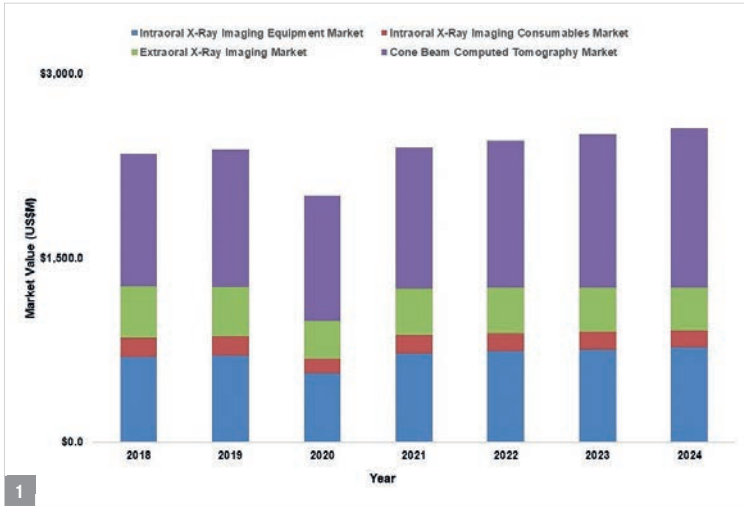


Fig. 1: The total volume of global dental imaging procedures is increasing every year, and most of that growth is in the CBCT segment. Fig. 2: In terms of value, Western Europe's dental imaging market trails behind that of North America. (Images: © iData Research)

Dental imaging is a crucial part of oral care, and the volume of imaging procedures is predicted to increase as the global population ages and experiences more dental problems. According to the latest market insights from iData, harmful consumer behaviours and artificial intelligence (AI) are also expected to have an influence on the growth of the dental imaging market.

The global dental imaging market saw less than two million procedures performed in 2021, and the European market accounted for less than 400,000 of them. The total volume of procedures is increasing every year, and most of that growth

is in the CBCT segment, followed by the intra-oral radiographic imaging market. Most companies direct their funds towards research and development in the CBCT market owing to its leading position.

One of the main trends in the dental imaging market is a shift towards AI and data insights to improve patient care. AI-driven technology can provide a personalised dental solution that fully adjusts to the specific clinical needs of each individual patient.

Research and development in AI technology has taken place mostly in dental radiography, and this new

Cosmetic usage boosting CBCT

Increased prevalence of harmful consumer behaviours, such as regular increases in sugar and fatty food consumption and inactivity, may result in dental caries. As a result, the overall volume of cosmetic procedures to restore normal oral and dental health is expected to rise.

Traditionally, 2D dental imaging machines have been used as the main tool for capturing an image of the mouth prior to procedures; however, 2D machines have a huge limitation in depicting the shape and form of mouth, as looking at a 3D object in 2D is not very accurate.

The use of CBCT in the dental industry is expected to increase as a result of the rise in need for cosmetic surgeries.

An ageing population requires more dental imaging

Dental problems can occur at any time in life, but the probability of their occurrence has a strong positive association with advanced age. In other words, as you get older, you are more likely to have dental and oral problems. Age-related dental problems include, but are not limited to, periodontitis and root and coronal caries.

Globally, there has been a shift in population dynamics. For example, across Europe, a significant proportion of the population is now geriatric. People in this age category require more extensive dental care, for example for the provision of implants and overdentures or for the treatment of age-related conditions. As the number of people in this age bracket needing these procedures increases, dental professionals will require more advanced dental radiographic devices.

COVID-19's impact on the dental imaging market

The global and European dental imaging markets experienced a steep decline in 2020; however, the effects of the COVID-19 pandemic on the dental imaging market are expected to vary by market segment. During the pandemic, non-essential visits to dental clinics were not possible, and this limited the ability of manufacturers to sell their products.

Crucially, the COVID-19 pandemic reduced the number of dental procedures in 2020, and this reduction was directly tied to respective countries' hospital and clinical prioritisations. Urgent procedures were performed, but patient safety necessitated meticulous preparation.

Dental imaging market set to keep growing

The dental imaging market has met growth expectations, and the volume of procedures presents an

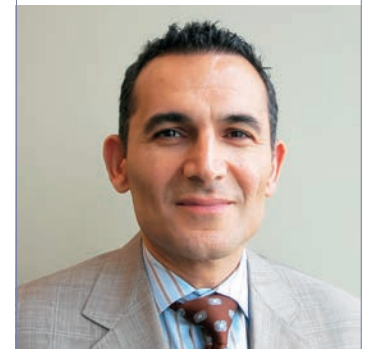
opportunity for manufacturers to enter the market. The market is predicted to grow alongside the ageing population and the increase in number and significance of dental imaging product innovations.

Overall, the global dental imaging market was valued at less than US\$2.5 billion (€2.2 billion) in 2021, and the European market was valued at slightly above US\$500 million. The global market is expected to grow moderately, and the European market is expected to experience a slight decline. ◀

About the authors



Ali Shakerdargah is a research analyst at iData Research. He develops and composes syndicated research projects regarding the medical device industry, publishing the Global Dental Imaging Market research report.



Dr Kamran Zamanian is CEO and founding partner of iData Research. He has spent over 20 years working in the market research industry with a dedication to the study of dental implants, dental bone grafting substitutes, prosthetics, as well as other dental devices used in the health of patients all over the globe.



is in the CBCT segment. As a result of the COVID-19 pandemic and the shutdown of dental offices, the total global market experienced a sharp decline in 2020 but had almost fully recovered by the end of 2021. Global market growth has been relatively steady in recent years as a result of product innovation and the ageing population.

Innovation driving growth in dental imaging market

The CBCT market is the largest segment in the dental imaging mar-

ket, followed by the intra-oral radiographic imaging market. Most companies direct their funds towards research and development in the CBCT market owing to its leading position.

The use of AI technology in dental imaging is expected to grow rapidly and become one of the main drivers of the dental imaging market.

Therefore, the complication rate of dental procedures was higher before the availability of 3D dental imaging tools.

The birth of CBCT scanners was a revolution in the dental industry, as it enabled dentists to capture 3D images and see the mouth from any angle. CBCT helps dentists to visualise the structures without the need of superimposition, and this advancement helps dentists to identify a patient's issues more clearly and to adopt a better treatment.

“Everyone has the power to become an innovator”

An interview with Dr Sumita Mitra. By Franziska Beier, Dental Tribune International



Dr Sumita Mitra has dedicated more than 30 years to the development of dental materials. (All images: © European Patent Office)

Dr Sumita Mitra is a chemist and awarded dental materials inventor. During her career at 3M, she developed a unique nanomaterial-based dental filler, for which she received the European Inventor Award 2021. This material and numerous other inventions of hers in the field of dental materials have been patented. Dental Tribune International spoke with Dr Mitra about how a bunch of grapes inspired her research efforts, about the greatest advantages of her developed material and about how she gives back to the next generation of inventors.

Why did you decide to go into chemistry and how did you become concerned with dental materials?

From a very early age I was fascinated by different materials. I often wondered what makes one material different from another—things like why paper is different from wood, or why fabric is different from our skin. I learnt that the answer is in the molecules—it is chemistry that is the central science that defines materials. I was so awestruck by the subject that I made up my mind to study chemistry in depth. I would often visit my father in his laboratory and peer over his shoulders as he did his chemistry experiments. After I joined the 3M company, I got an opportunity to join its Dental Products Laboratory to develop new polymer matrices for dental composites. I jumped at that prospect and spent most of my career there, developing many new materials technologies, including the development of nanotechnology for use in dentistry.

You have developed a nanocomposite restorative material (Filtek Supreme, 3M), that has already been used for more than 1 billion tooth restorations. How did you come up with the idea of using nanotechnology?

Until the late 1990s dentists wanting to perform natural-looking tooth repairs relied on a combination of two separate materials. Microfills were aesthetically pleasing but too weak to be used for stress-bearing regions of the incisal edges and for selling teeth in the posterior region of the mouth. Less attractive hybrid and microhybrid composites were

stronger, but lost their shine and became rough from brushing and chewing. This was both inconvenient and expensive for dentists and their patients. So, we wanted to create one material that would not only be strong and durable but also have the long-lasting lustrous beauty of natural teeth.

I realised that the key problem was that the existing filler technology used to reinforce dental composites had limitations. Around that time, nanotechnology was an emerging science. I hypothesised that developing nano-particle technology for use as dental fillers could allay most of the problems and afford us a universal filling material. This is because nanoparticles are much smaller in size than the wavelength of light and thus could

provide unique aesthetic properties. In addition, nanoparticles had the potential of providing mechanically strong materials. With this idea, and with the help of a team of 3M scientists, I set about the task of developing suitable nanofillers and incorporating them into a resin matrix to generate nanocomposites with superior characteristics. Our initial approach was to make tiny nanoparticles of several sizes, but this approach was disappointing since it did not provide all the desirable characteristics, especially the required rheology or handling properties needed by dentists. I realised that this was because we needed nanoparticles of a wide size distribution to get packing efficiency in the composite. It sounds simple but was not easy to achieve with the initial nanoparticles.

The decisive idea for the material was inspired by a particular fruit. Could you tell us more about this?

The breakthrough moment came as I was looking at a cluster of grapes in a bowl. If one observes a bunch of grapes, there are grapes of different sizes, some small and some large, with the small ones fitting in between the gaps created by the large ones, leading to optimum use of space. Also, the sizes of the bunches can vary greatly—there can be clusters of five, 20 or 100 grapes, and so on. If one or two individual grapes are plucked out, the overall cluster doesn't change that much. My theory was that we could first assemble the nanoparticles into nanoclusters of wide size distribution and then combine them with individual nanomeric particles to fill any voids to provide a synergistic mix that could

then be incorporated in a dental resin to create the composite. This is what I set out to do, with the help of the excellent team at 3M.

The end result of all that hard work is the universal filling material 3M Filtek Supreme. Since the original material was introduced in 2002, several updates have been made and a family of Filtek products has been introduced for the benefit of dentists and their patients.

National Inventors Hall of Fame, the American Chemical Society and many others, including most recently the European Patent Office for this invention. It is quite humbling to be included in the same league as so many well-known inventors whose work has greatly benefited society. This type of recognition validates the importance of the scientific contributions of scientists and increases public awareness of the pivotal role that science and technology play for the advancement



Dr Mitra at the 3M Innovation Center in Minneapolis in Minnesota in the US.

Would you please explain how the material works exactly and what some of its greatest advantages for dentists and their patients are?

The 3M Filtek Supreme product is an uncured composite paste, which comes in a number of shades that make it possible to exactly match the patients' dentition. After using a dental adhesive, the dentist places the composite and shapes it according to the required anatomy, finally curing it in place by a short exposure to blue light. The greatest advantage is that the material is very versatile and can be used in all areas of the mouth— anterior, posterior, and on incisal or molar surfaces. It is highly aesthetic and has the shine and opalescence of a natural tooth. It is extremely durable and withstands the forces of chewing and brushing without losing its shine for a long time. Dentists all over the world have expressed their enthusiasm and shared examples of their work, which is very gratifying.

Your material has been patented. Aside from this product, do you hold any other patents for dental applications?

I hold 100 US patents, 58 European patents and their corresponding equivalents in other countries. The majority of my patents are in the area of dental materials.

You have been awarded and honoured many times, including being inducted into the US National Inventors Hall of Fame in 2018. Last year, you won the European Inventor Award 2021—in the category Non-European Patent Office countries. How meaningful are these awards to you?

I feel greatly honoured to be recognised by organisations like the

of society. Another important aspect is that the award creates role models for aspiring scientists who pursue careers in science, technology, engineering and mathematics (STEM)-related fields. Furthermore, awards like these give a voice to science and help in influencing greater funding for scientific research and policymaking.

In your opinion, what are the essential characteristics that a person needs in order to start an innovation?

Basically, it is a combination of curiosity, exploration and imagination. Of course, you need a scientific training, but above all, you have to try new ways of doing things—a way that is more convenient and or easier. The other thing is to have passion coupled with persistence. The first attempts may not be successful, but failures should never discourage us. They only show us that there is another pathway toward achieving a goal.

How do you inspire young people and what would you tell the next generation of potential innovators?

After my retirement, I have spent many hours volunteering and teaching at a number of local organisations, encouraging STEM education at all levels, primary school to postgraduate. It is a way for me to give back to society for all the opportunities I have had.

Everyone has the power to become an innovator. The important thing is to understand that a solid foundation in STEM-related fields gives young people the toolset to unleash their creativity and design better approaches to improving the well-being of society. I always tell young people, “Believe in yourself, seek help when needed, and never give up.” ◀



Dr Mitra loves art and enjoys painting with watercolors in her free time.

Artificial intelligence may automate design of biomimetic single-tooth prostheses

New experimental study from Hong Kong explores AI in dentistry

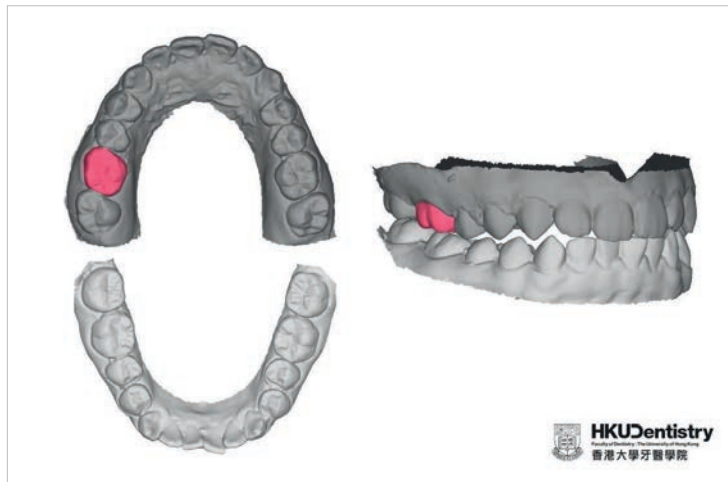
■ Even with the support of modern CAD/CAM technology, creating a dental prosthesis is still rather time-consuming, resulting in more chair time and high costs for patients. To facilitate the design of molar crowns, researchers from the Faculty of Dentistry at the University of Hong Kong (HKU) and the Department of Computer Science of Chu Hai College of Higher Education in Hong Kong collaborated to develop a novel approach using artificial intelligence (AI).

When asked what inspired the research, lead author Dr Walter Yu Hang Lam, clinical assistant professor in prosthodontics at the Division of Restorative Dental Sciences at HKU, told *Dental Tribune International*: “Some patients sense a very subtle hair-thin high spot on their dental prosthesis. Therefore, in the dental curriculum, a significant proportion of time is dedicated to occlusion theory and clinical training to provide a dental prosthesis that fits the patient’s mouth. My colleagues and I hoped to figure out a solution for improved treatment efficiency and patient experience.”

In order to restore the patient’s original appearance, masticatory function and general oral health, dental prostheses should have the same occlusal morphology and 3D position of the natural teeth. These can be deduced for a missing tooth from those of the surrounding dentition because the teeth of an individual are all controlled by the same set of genes and exposed to the same oral environment. The researchers hypothesised that AI could thus generate the design for a single-tooth prosthesis based on the characteristics of the remaining dentition.

The research team used a machine learning approach called a generative adversarial network (GAN) to train and validate their AI system and have tested it on 175 participants. The system was able to reconstruct the shape of a natural tooth and automate the process of dental prostheses design based only on the digital model of the patient’s dentition.

“The 3D GAN algorithm was selected due to its superior performance on 3D object reconstruction compared



■ Hong Kong researchers have demonstrated that their AI system could generate the design of a molar (red) based on the features of the remaining dentition (dark grey). (Image: © HKU)

with other AI algorithms. In the preliminary study, 3D GAN was able to rebuild similar shapes to the original teeth for 60% of the cases. It is expected to mature with more AI training data,” commented co-author Dr Reinhard Chun Wang Chau, research assistant in the Division of Restorative Dental Sciences and of Applied Oral Sciences

and Community Dental Care at HKU, in a press release. For future research, the team proposes to investigate whether the presence of opposing teeth will help the AI to generate a more natural tooth.

Asked about the advantages of this method for dental professionals and patients, Dr Lam said: “It’s less time-consuming

for both of them. Dentists will spend less time on registering jaw relationships and chairside adjustment, greatly facilitating the entire treatment process and enabling them to take on more cases.”

He continued: “Patients will spend less time and money on the treatment. In addition, the dental prostheses they receive will fit better to their remaining dentition and are thus less likely to cause jaw problems.”

According to Dr Lam, the research group hopes to make the AI technology available for dental professionals within the next five years, after having tested its accuracy further in simulated and clinical scenarios. Moreover, the researchers believe that the method may be applied to the fabrication of crowns for other teeth and of multi-unit restorations in the future.

The study, titled “Artificial intelligence-designed single molar dental prostheses: A protocol of prospective experimental study”, was published online on 2 June 2022 in *PLOS ONE*. ◀

3D printing more accurate than milling

Japanese study indicates 3D-printed dental crowns are of higher quality than milled crowns



■ Using the exact same dataset and an industrial 3D digitiser to identify deviations, researchers at Tohoku University Graduate School of Dentistry in Japan found that producing a crown by digital light processing (DLP) 3D printing results in a better-quality product than can be achieved through milling.

CAD/CAM-produced milled crowns have proved a popular alternative to traditional metallic restorations in recent years, thanks to the better wear and aesthetic qualities of resin-composites. However, the new study indicates that advances in DLP printing can offer dentists a far better product in terms of less wastage and higher accuracy than has previously been available.

Compared with the milled crowns created during the study, the DLP-printed crowns were consistently more accurate and had fewer marginal discrepancies. The researchers noted that, particularly at the crown cusps, the milled crowns had a higher rate of dimensional deviations and that, when offset correction was attempted on the internal surfaces of the milled products that had negative deviations, grooves would result.

DLP-based 3D printing achieved a higher level of dimensional fitting accuracy and high trueness, regardless of the abutment shape. When it comes to milling, the trueness is very dependent upon the material properties, and those which are more brittle, such as ceramics and polymer-infiltrated ceramics, are prone to chipping during processing,

meaning that too much milling can result in a lower-quality piece.

DLP also provides a broader possible range of fitting accuracy than can be provided by milling.

The researchers noted that future studies could evaluate the fracture resistance and biocompatibility of 3D-printed crowns as permanent prostheses and that additional research utilising different printing parameters and fabrication systems would be useful.

The study, titled “Comparison of the accuracy of resin-composite crowns fabricated by three-dimensional printing and milling methods”, was published online on 6 July 2022 in *Dental Materials Journal*, ahead of inclusion in an issue. ◀

Hospital in South Korea to develop first 3D-integrated dental analysis platform

New platform will help dental professionals design optimised treatment plans

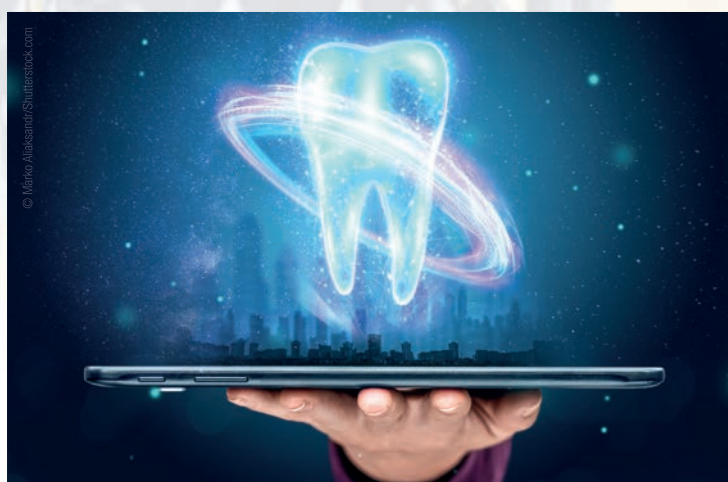
■ Kyung Hee University Dental Hospital has recently signed a business agreement with Osteoid, a developer of 3D medical imaging solutions, to create South Korea’s first 3D-integrated dental analysis platform, TWEeMAC. The state-of-the-art dental platform will digitise patients’ oral health information in order to facilitate diagnosis and treatment planning.

According to a recent press release, the platform will be able to diagnose snoring, sleep apnoea, dental asymmetry and maxillofacial deformities. It will also be able to analyse

hard- and soft-tissue aesthetics and maxillary arch narrowness, among others.

“Based on the big data accumulated for more than 50 years, we started with the intention of helping other hospitals establish accurate oral conditions and treatment plans for patients,” commented hospital director Prof. Hwang Eui-Hwan.

“We will strive to become a dental hospital that leads dentistry’s research and treatment field through pre-emptive responses in a rapidly changing environment,” he added.

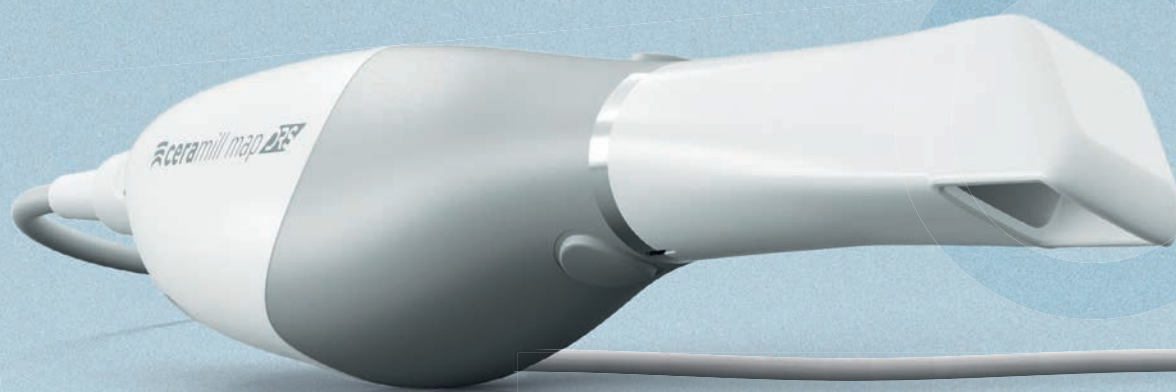


Commenting on the platform, Prof. Kim Seong-Hun, chair of the Department of Orthodontics at Kyung Hee University, stated: “We can digitise the conditions of previous patients to derive comprehensive analysis results quickly based on [artificial intelligence].”

He added that the data gained from the platform will help develop optimised treatment plans for dental patients.

With this partnership, Osteoid seeks to improve the digital dental diagnostic and therapeutic market. ◀

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